(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（Ａ）**　(11)特許出願公開番号

特開平10－172587

(43)公開日　平成10年(1998)６月26日

(51)Int.Cl.[6]	識別記号	FI		
Ｈ０１Ｍ　8/02		Ｈ０１Ｍ　8/02		Ｒ
				Ｅ
				Ｙ
				Ｚ
8/04		8/04		Ｋ

審査請求　有　請求項の数11　ＯＬ　（全 12 頁）　最終頁に続く

(21)出願番号　特願平8－326733

(22)出願日　平成８年(1996)12月６日

(71)出願人　000003078
株式会社東芝
神奈川県川崎市幸区堀川町72番地

(72)発明者　椋　儀晴
神奈川県川崎市幸区小向東芝町１番地　株式会社東芝研究開発センター内

(72)発明者　宗内　篤夫
神奈川県川崎市幸区小向東芝町１番地　株式会社東芝研究開発センター内

(72)発明者　霜鳥　宗一郎
神奈川県川崎市幸区小向東芝町１番地　株式会社東芝研究開発センター内

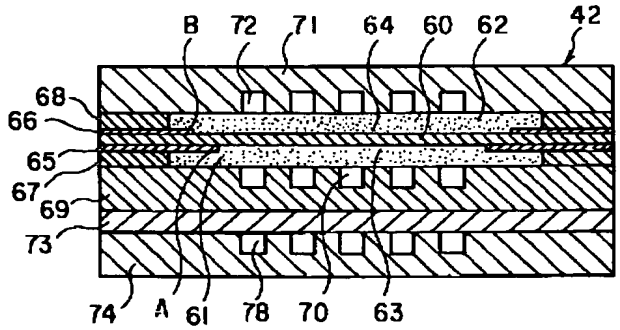
(74)代理人　弁理士　鈴江　武彦　（外６名）

(54)【発明の名称】　固体高分子型燃料電池

(57)【要約】

【課題】長寿命化を図れる固体高分子型燃料電池を提供する。

【解決手段】高分子電解質膜６０を相互で挟持するように配置された燃料極６１および酸化剤極６２とを含む単位セル４２を備えた固体高分子型燃料電池において、燃料極６１および酸化剤極６２は、それぞれの高分子電解質膜６０に接触する領域のエッジ部分Ａ，Ｂが高分子電解質膜６０を挟んで重合しない形状に形成されている。



【特許請求の範囲】
【請求項１】高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝とを含む単位セルを備えた固体高分子型燃料電池において、
前記複数の酸化剤供給溝は、前記酸化剤極側集電体の前記酸化剤極に接触する面内に、ほぼ長方形の領域に亙って上記長方形の長辺に沿って酸化剤ガスを案内すべく設けられていることを特徴とする固体高分子型燃料電池。
【請求項２】前記複数の燃料供給溝は、前記燃料極側集電体の前記燃料極に接触する面で前記長方形の領域に対向する領域に上記長方形の長辺に沿って燃料ガスを案内すべく設けられていることを特徴とする請求項１に記載の固体高分子型燃料電池。
【請求項３】前記単位セルに前記燃料ガスおよび前記酸化剤ガスを供給するための内部マニホールドは、前記長方形の領域における短辺側で上記長方形の領域の外側に設けられていることを特徴とする請求項１に記載の固体高分子型燃料電池。
【請求項４】高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝とをを含む単位セルを備えた固体高分子型燃料電池において、
前記燃料極および前記酸化剤極は、それぞれの前記高分子電解質膜に接触する領域のエッジ部分が上記高分子電解質膜を挟んで重合しない形状に形成されていることを特徴とする固体高分子型燃料電池。
【請求項５】前記燃料極および前記酸化剤極は、前記高分子電解質膜に接触する面積が異なっていることを特徴とする請求項４に記載の固体高分子型燃料電池。
【請求項６】前記燃料極および前記酸化剤極には前記高分子電解質膜に接触する領域を形成する凸部がそれぞれ形成されており、これら凸部を取り囲むように上記凸部の高さとほぼ同じ厚みに形成された額縁状補強シートが装着されていることを特徴とする請求項４に記載の固体高分子型燃料電池。
【請求項７】前記額縁状補強シートは、前記高分子電解質膜と同じ材料で形成されていることを特徴とする請求項６に記載に固体高分子型燃料電池。
【請求項８】高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝と、前記燃料極側集電体の背面側に設けられて冷却水を案内する冷却板と、この冷却板と前記燃料極側集電体との間に設けられて上記冷却板によって案内された水の一部が上記燃料極側集電体へ移行する量を制御する加湿水透過板とを含む単位セルを備えた固体高分子型燃料電池において、
前記加湿水透過板は、導電性の非焼結部材で形成されていることを特徴とする固体高分子型燃料電池。
【請求項９】前記加湿水透過板は、導電材料を含む多孔質構造のフッ素系樹脂材料の薄板で形成されていることを特徴とする請求項８に記載の固体高分子型燃料電池。
【請求項１０】前記加湿水透過板は、大きさの異なる孔が穿設された平板で形成されていることを特徴とする請求項８に記載の固体高分子型燃料電池。
【請求項１１】高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝とを含む単位セルを複数積層した積層体が、前記単位セルの積層方向に対して直交する方向に複数並設され、隣接する前記積層体間が電気的に直列に接続されていることを特徴とする固体高分子型燃料電池。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、水素イオン伝導性を有する高分子膜あるいは水素イオン伝導性を有する無機または有機材料粉末と結着剤としての高分子材料との複合材を電解質として用いる固体高分子型燃料電池に関する。
【０００２】
【従来の技術】近年、高効率のエネルギ変換装置として、燃料電池が注目を集めている。燃料電池は、用いる電解質の種類により、たとえばアルカリ型，固体高分子型，リン酸型などの低温作動燃料電池と、溶融炭酸塩型，固体酸化物型などの高温作動燃料電池とに大別される。

【０００３】これらのうち、電解質としてイオン伝導性を有する高分子電解質膜を用いる固体高分子型燃料電池（ＰＥＦＣ）は、コンパクトな構造で高出力密度が得られ、しかも簡易なシステムで運転が可能なことから、宇宙用、離島用、定地用、車両用などの電源として注目されている。

【０００４】高分子電解質膜としては、スルホン酸基を持つポリスチレン系の陽イオン交換膜、フルオロカーボンスルホン酸とポリビニリデンフルオライドとの混合物質、フルオロカーボンマトリックスにトリフルオロエチレンをグラフト化して添加したもの等が知られている。最近ではパーフルオロカーボンスルホン酸膜（たとえば、ナフィオン：商品名、デュポン社製）等が用いられている。

【０００５】このような高分子電解質膜を電解質として用いる固体高分子型燃料電池は、通常、図１７に示すように形成された単位セル１を複数積層した積層体構造として構成されている。

【０００６】単位セル１は、高分子電解質膜１０と、白金等の触媒を担持した多孔質体で形成されて高分子電解質膜１０を相互で挟持するように配置された燃料極１１および酸化剤極１２と、燃料極１１の背面に接触配置された多孔質体製の燃料極側集電体１３と、酸化剤極１２の背面に接触配置された酸化剤極側集電体１４と、燃料極側集電体１３の燃料極１１に接触する面に形成されて燃料極１１に燃料ガスを分配供給する複数の燃料供給溝１５と、酸化剤極側集電体１４の酸化剤極１２に接触する面に形成されて酸化剤極１２に酸化剤ガスを分配供給する複数の酸化剤供給溝１６と、燃料極側集電体１３の背面側に設けられた冷却板１７と、この冷却板１７に設けられて冷却水を案内する冷却水案内溝１８と、この冷却水案内溝１８によって案内された水の一部が燃料極側集電体１３へ移行する量を制御する加湿水透過板１９とで構成されている。

【０００７】なお、図１７中、２０，２１は、高分子電解質膜１０，燃料極１１および酸化剤極１２からなる膜電極複合体の周囲を取り囲んで燃料ガスおよび酸化剤ガスの漏洩を防止するとともに燃料極側集電体１３と酸化剤極側集電体１４との間の絶縁を確保する額縁状スペーサを示している。また、冷却板１７を介在させない場合には燃料極側集電体１３と酸化剤極側集電体１４とが一体化されている場合もある。

【０００８】高分子電解質膜１０，燃料極１１および酸化剤極１２は、シート状に形成されており、内部抵抗低減のためにその厚みは１㎜以下に形成されている。また、高分子電解質膜１０，燃料極１１および酸化剤極１２は、生産性を考慮して正方形に形成されている場合が多い。そして、その面積は発電に必要な電流値および単位面積当たりの電流値すなわち電流密度によって決まり、概ね１００cm^2 以上、すなわち一辺が１０cm以上に設定されているものが多い。

【０００９】燃料極側集電体１３および酸化剤極側集電体１４は、図１８に燃料極側集電体１３を代表して示すように、高分子電解質膜１０や各極１１，１２の形状に合せて正方形に形成されているものが多い。そして、中央部に各極１１，１２の形状に合せて正方形の領域を設定し、この正方形の領域に燃料ガス供給溝１５（酸化剤ガス供給溝１６）を複数平行に設けている。冷却板１７についても同様で、中央部に各極１１，１２の形状に合せて正方形の領域を設定し、この正方形の領域に冷却水案内溝１８を複数平行に設けている。

【００１０】燃料ガス供給溝１５の両端部は、それぞれ燃料ガス供給溝１５とほぼ同じ深さに形成された連絡通路２２，２３を介して積層要素の周縁部に積層方向に設けられた燃料ガス供給マニホールド２４および燃料ガス排出マニホールド２５に通じている。同様に、酸化剤ガス供給溝１６の両端部は酸化剤ガス供給マニホールド２６および酸化剤ガス排出マニホールド２７に通じており、冷却水案内溝１８の両端部は冷却水供給マニホールド２８および冷却水排出マニホールド２９に通じている。一方、加湿水透過板１９は、金属粉末または親水性のカーボン粉末を焼結して得た導電性の多孔質薄板で形成されている。

【００１１】このように構成された単位セル１の起電力は１Ｖ以下と小さいため、複数の単位セルを積層し、直列に接続して必要な起電力を得るようにしている。しかしながら、上記のように構成された従来の固体高分子型燃料電池にあっては次のような問題があった。

【００１２】すなわち、燃料極１１に水素を含む燃料ガスを供給するとともに酸化剤極１２に酸素を含む酸化剤ガスを供給しながら電池反応を行なわせると、この電池反応の副産物として酸化剤極１２側に水が発生する。この水は生成水と呼ばれている。この生成水が多量に存在していると、酸化剤ガスの供給の妨げになる。したがって、生成水を速やかに外部に排除する必要がある。生成水は酸化剤ガス供給溝１６に移行し易い。このため、一般には、酸化剤ガスを過剰に供給し、未反応の酸化剤ガスによって排出する方法が採られている。この方法では、過剰な酸化剤ガスの流量とともに酸化剤ガスの流速が重要なパラメータとなる。すなわち、流速が早いほど生成水を多く排出できる。

【００１３】しかし、従来の固体高分子型燃料電池では、正方形に形成された酸化剤極側集電体１４の中央部に正方形の領域を設定し、この正方形の領域に酸化剤ガス供給溝１６を複数平行に設けているので、酸化剤ガスの流速を上げることが困難で、電池の寿命を長くすることが困難であった。

【００１４】なお、酸化剤ガスの流速を上げるには、各酸化剤ガス供給溝１６の断面積、つまり溝の深さと幅を小さくすることで実現できるが、電極の面積が小さい場

合には加工精度の点から実現が困難となる。

【００１５】また、従来の固体高分子型燃料電池にあっては、燃料極１１と酸化剤極１２とを同一寸法および同一面積に形成している。このため、燃料極１１の高分子電解質膜１０に接触する領域のエッジ部と酸化剤極１２の高分子電解質膜１０に接触する領域のエッジ部分とが高分子電解質膜１０を挟んで重なったものとなり、高分子電解質膜１０，燃料極１１および酸化剤極１２からなる膜電極複合体をプレス成形するときにエッジ部分に圧力が集中し、高分子電解質膜１０の上記エッジ部分に接触している部分が両方から押されて破損する虞があった。さらに、高分子電解質膜１０の上記両エッジ部分に挟まれている部分は、発電時ではセルの締め付けにより、常に機械的ストレスが掛かっている状態にあり、長時間運転を行うと高分子電解質膜１０の上記両エッジ部分に挟まれている部分が劣化し、破損する可能性もあった。

【００１６】また、従来の固体高分子型燃料電池にあっては、金属粉末またはカーボン粉末を焼結して得た加湿水透過板１９を用いている。このような焼結体では、焼結の条件によって多孔質構造に異なりが生じ易い。また、焼結時に均一な孔径や細孔容量のコントロールが困難である。このため、同じ加湿水透過板１９においても各部の孔径や細孔容量にばらつきが生じ、さらに加湿水透過板１９の一枚一枚について孔径や細孔容量にばらつきが生じる。このようなばらつきにより、高分子電解質膜１０に供給される加湿水が不均一になり、電池性能が不安定になる問題もあった。

【００１７】さらに、セルのコンパクト化のためには薄く、機械的強度のあるものが必要となるが、粉末を焼結する従来の製作法では、概略１㎜程度の厚さが必要となる。また、金属またはカーボンの多孔質体であるため、薄くすると機械的強度がなくなってしまい、結局、従来の加湿水透過板では薄く、機械的強度のあるものを製作できず、コンパクトなセルを実現することはできない。

【００１８】

【発明が解決しようとする課題】上述の如く、従来の固体高分子型燃料電池にあっては、生成水の速やかな排出が困難で、しかも高分子電解質膜に大きな機械的ストレスが加わり易く、そのうえ高分子電解質膜に良好に給水できないなどの理由で、電池としての寿命が短いという問題があった。そこで本発明は、寿命を著しく向上させ得るとともにコンパクトな固体高分子型燃料電池を提供することを目的としている。

【００１９】

【課題を解決するための手段】上記目的を達成するために、請求項１に係る発明では、高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝とを含む単位セルを備えた固体高分子型燃料電池において、前記複数の酸化剤供給溝が、前記酸化剤極側集電体の前記酸化剤極に接触する面内に、ほぼ長方形の領域に亙って上記長方形の長辺に沿って酸化剤ガスを案内すべく設けられていることを特徴としている。

【００２０】なお、請求項１に係る発明において、前記複数の燃料供給溝が、前記燃料極側集電体の前記燃料極に接触する面で前記長方形の領域に対向する領域に上記長方形の長辺に沿って燃料ガスを案内すべく設けられていてもよい。

【００２１】また、請求項１に係る発明において、前記単位セルに前記燃料ガスおよび前記酸化剤ガスを供給するための内部マニホールドが、前記長方形の領域における短辺側で長方形の領域の外側に設けられているとさらによい。

【００２２】上記目的を達成するために、請求項４に係る発明では、高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝とをを含む単位セルを備えた固体高分子型燃料電池において、前記燃料極および前記酸化剤極が、それぞれの前記高分子電解質膜に接触する領域のエッジ部分が上記高分子電解質膜を挟んで重合しない形状に形成されていることを特徴としている。

【００２３】なお、請求項４の発明において、前記燃料極および前記酸化剤極は、高分子電解質膜に接触する面積が異なっていてもよい。また、請求項４の発明において、前記燃料極および前記酸化剤極には前記高分子電解質膜に接触する領域を形成する凸部がそれぞれ形成されており、これら凸部を取り囲むように上記凸部の高さとほぼ同じ厚みに形成された額縁状補強シートが装着されていてもよい。そして、前記額縁状補強シートは、前記高分子電解質膜と同じ材料で形成されていてもよい。

【００２４】上記目的を達成するために、請求項８に係る発明では、高分子電解質膜と、この高分子電解質膜を相互で挟持するように配置された燃料極および酸化剤極と、前記燃料極の背面に接触配置された燃料極側集電体と、前記酸化剤極の背面に接触配置された酸化剤極側集電体と、前記燃料極側集電体の前記燃料極に接触する面

に形成されて上記燃料極に燃料ガスを分配供給する複数の燃料供給溝と、前記酸化剤極側集電体の前記酸化剤極に接触する面に形成されて上記酸化剤極に酸化剤ガスを分配供給する複数の酸化剤供給溝と、前記燃料極側集電体の背面側に設けられて冷却水を案内する冷却板と、この冷却板と前記燃料極側集電体との間に設けられて上記冷却板によって案内された水の一部が上記燃料極側集電体へ移行する量を制御する加湿水透過板とを含む単位セルを備えた固体高分子型燃料電池において、前記加湿水透過板は、導電性の非焼結部材で形成されていることを特徴としている。

【００２５】なお、請求項８に係る発明において、前記加湿水透過板が、導電材料を含む多孔質構造のフッ素系樹脂材料の薄板で形成されていてもよいし、大きさの異なる孔が形成された平板で形成されていてもよい。

【００２６】請求項１に係る発明では、複数の酸化剤供給溝を、酸化剤極側集電体の酸化剤極に接触する面に、ほぼ長方形の領域に亙って上記長方形の長辺に沿って酸化剤ガスを案内すべく設けているので、各酸化剤供給溝の深さや幅を小さくすることなく、つまり製作の困難化を招くことなく、酸化剤ガスの流速を増加させることができ、この結果、生成水を良好に排除できる。

【００２７】すなわち、今、燃料極（酸化剤極）の面積を基準にして考える。前述の如く電極の面積は電流密度によって決まり、仮に１００cm^2 必要であるものとする。従来の固体高分子型燃料電池では正方形の電極を用いているので、一辺が１０cmとなる。これに対して、請求項１に係る発明では、複数の酸化剤供給溝を、酸化剤極側集電体の酸化剤極に接触する面に、ほぼ長方形の領域に亙って設けているので、電極を正方形に形成する必要はない。たとえば短辺が７cm、長辺が１４．３cmの長方形に形成してもよいことになる。そして、請求項１に係る発明では、長方形の長辺に沿って酸化剤ガスを案内するように酸化剤供給溝を設けている。したがって、溝の深さ、溝幅、配設ピッチが同じであるとして比較すると、従来に比べて請求項１に係る発明では溝の本数が少ないことになる。酸化剤ガスの供給圧力が一定であるとすると、酸化剤供給溝の本数が少ない分だけ酸化剤供給溝内を通流する酸化剤ガスの流速を増加させることができる。したがって、生成水を良好に排除できることになる。

【００２８】また、このように電極を長方形に形成できることは、単位セルの平面形状も長方形に形成できることになり、燃料電池積層体の積層方向と直交する断面積も長方形に形成できることになる。つまり、必要な電極面積を確保した状態で燃料電池積層体を偏平に近い形状に形成できることになるので、たとえば電気自動車等のように高さの低い設置空間しか持たない対象にも対応することが可能となる。

【００２９】請求項４に係る発明では、燃料極および酸化剤極の高分子電解質膜に接触する領域のエッジ部分が高分子電解質膜を挟んで重合しないように燃料極および酸化剤極を形成している。したがって、高分子電解質膜には両エッジ部分よって挟まれる部分が存在しないことになる。このため、膜電極複合体をプレス成形するときは勿論こと、発電時のセル締め付けに際しても上述したエッジ部分の存在によって高分子電解質膜が破損するのを防止することが可能となる。

【００３０】請求項８に係る発明では、加湿水透過板を導電性の非焼結部材、たとえば導電材料を含む多孔質構造のフッ素系樹脂材料の薄板や細孔の形成された平板で形成しているので、孔径や細孔容量のコントロールが極めて容易である。したがって、高分子電解質膜に加湿水を均一に供給することが可能となる。

【００３１】

【発明の実施の形態】以下、図面を参照しながら本発明の実施形態を説明する。図１には本発明の一実施形態に係る固体高分子型燃料電池、ここには固体高分子型燃料電池４１を４個直列に接続して電気自動車用の電源を構成した例の斜視図が示されている。

【００３２】各固体高分子型燃料電池４１は、図２に示すように、単位セル４２を複数積層し、この積層体の両端部に導電板４３ａ，４３ｂ、絶縁板４４ａ，４４ｂ、端板４５ａ，４５ｂをそれぞれ当てがい、この状態で端板４５ａ，４５ｂの４隅位置間を絶縁ロッド４６を使って締付けて一体化したものとなっている。

【００３３】このように構成された各固体高分子型燃料電池４１は、積層方向と直交する断面が長方形に形成されている。そして、４個の固体高分子型燃料電池４１を、その断面における短辺と短辺とを隣接させ、単位セル４２が積層される方向に対して直交する方向に並設し、導電板４３ａ，４３ｂに突設されたボスバー４７をリード線４８で接続して隣接する積層体間を電気的に直列に接続している。このように固体高分子型燃料電池４１を配置することにより、電源を設置するスペースの全高を低くでき、自動車の床下などの高さの低いスペースに設置できるようにしている。

【００３４】各固体高分子型燃料電池４１には、従来の電池と同様に、発電に必要な燃料ガス、酸化剤ガス、冷却水を供給および排出するための、燃料ガス供給マニホールド４９ａ，燃料ガス排出マニホールド４９ｂ、給水マニホールド５０ａ，排水マニホールド５０ｂ、酸化剤ガス供給マニホールド５１ａ，酸化剤ガス排出マニホールド５１ｂが積層方向に形成されている。この例では隣接する固体高分子型燃料電池４１の対応するマニホールド同士を直列に接続している。勿論、並列に供給することもできる。

【００３５】図３には単位セル４２の分解斜視図が示されている。単位セル４２は、公知のものと同様の材質で形成された高分子電解質膜６０を備えている。この高分

子電解質膜６０は厚さがたとえば０．１８㎜程度のもので、両面には高分子電解質膜より小さい面積でマニホールドの形成されている側に短辺が位置するように長方形（たとえば短辺１０㎝、長辺２０㎝、電極面積２００㎝^{2}）に形成された燃料極６１と酸化剤極６２とが接触配置されている。燃料極６１および酸化剤極６２は、厚さがたとえば０．４㎜のカーボン製多孔質体の表面に白金を含んだカーボン粒子を塗布したもので形成されている。

【００３６】燃料極６１には、図６および図７に示すように高分子電解質膜６０に接触する長方形の領域（面積）を規定する凸部６３が形成されている。同様に、酸化剤極６２にも図６および図７に示すように高分子電解質膜６０に接触する長方形の領域を規定する凸部６４が形成されている。凸部６４の面積は凸部６３の面積とは異なり、ここでは大に設定されている。すなわち、凸部６３のエッジ部Ａと凸部６４のエッジ部Ｂとが高分子電解質膜６０を挟んで積層方向に重ならない面積関係となっている。具体的には、エッジ部Ａよりエッジ部Ｂが２～５㎜外側に位置する面積関係となっている。そして、燃料極６１に形成された凸部６３を取り囲むように、凸部６３の高さとほぼ同じ厚みのフッ素樹脂系シートあるいは高分子電解質膜６０と同じ材質で凸部６３の高さとほぼ同じ厚みのシート形状に形成された額縁状補強シート６５が装着されている。同様に、酸化剤極６２に形成された凸部６４の周囲にも同様のシート形状に形成された額縁状補強シート６５が装着されている。また、燃料極６１および酸化剤極６２の外周部分には、これら外周部分とほぼ同じ厚みを有したフッ素ゴム等の絶縁性シートで額縁状に形成されたシール材６７，６８が配置されている。

【００３７】燃料極６１の背面側、つまり燃料極６１の図３および図６中下面側には、燃料極６１への燃料ガスの供給機能と集電機能とを発揮する燃料極側集電板６９が接触配置されている。この燃料極側集電板６９は、親水性のカーボン多孔質板で形成されている。燃料極側集電板６９における燃料極６１との接触面内には、図５および図６にも示すように、燃料極６１に燃料ガスを供給するための燃料供給溝７０が燃料極６１の面積より小さな長方形の領域Ｃに燃料極６１の長辺に沿う方向に延びる関係に複数形成されている。燃料供給溝７０は、たとえば幅１㎜、深さ０．５㎜、長さ２０㎝、２㎜ピッチに５０本設けられている。同様に、酸化剤極６２の背面側、つまり酸化剤極６２の図３および図６中上面側には、酸化剤極６２への酸化剤ガスの供給機能と集電機能とを発揮する酸化剤極側集電板７１が接触配置されている。この酸化剤極側集電板７１は、緻密なカーボン板で形成されている。酸化剤極側集電板７１における酸化剤極６２との接触面内には、図４および図６に示すように、酸化剤ガスを酸化剤極６２に供給するための酸化剤供給溝７２が酸化剤極６２の面積より小さな長方形の領域Ｄに酸化剤極６２の長辺に沿う方向に延びる関係に複数形成されている。この酸化剤供給溝７２も、たとえば幅１㎜、深さ０．５㎜、長さ２０㎝、２㎜ピッチに５０本設けられている。なお、図４は酸化剤極側集電板７１を図３における下側から見た図として示されている。

【００３８】燃料極側集電板６９の図３および図６中下面側には加湿水透過板７３が接触配置されており、この加湿水透過板７３の図３および図６中下面側には冷却板７４が接触配置されている。加湿水透過板７３は、導電性を有する非焼結板、たとえば図８に示すように、燃料ガス供給溝７０の配設領域と対向する領域に孔径１０μｍの細孔７５を数百個設けたステンレスの薄板７６の両面に、孔径１０μｍ、細孔容量７０％の多孔質フッ素樹脂系シートにカーボンを３０％混入させた薄板７７を配置して一体化した厚さ０．１６㎜のもので形成されている。

【００３９】冷却板７４は緻密なカーボン板あるいは金属板で形成されている。冷却板７４の加湿水透過板７３側に位置する面には、冷却水を案内するための案内溝７８が燃料ガス供給溝７０の配設領域と対向する領域に燃料ガス供給溝７０と平行に複数形成されている。

【００４０】高分子電解質膜６０、額縁状補強シート６５，６６、シール材６７，６８、燃料極側集電板６９、酸化剤極側集電板７１、加湿水透過板７３、冷却板７４の両短辺部（長方形の領域Ｃ，Ｄの短辺側で、かつ上記長方形の領域外）には、燃料ガス供給マニホールド４９ａおよび燃料ガス排出マニホールド４９ｂを構成する孔８０，８１、給水マニホールド５０ａおよび排水マニホールド５０ｂを構成する孔８２，８３、酸化剤ガス供給マニホールド５１ａおよび酸化剤ガス排出マニホールド５１ｂを構成する孔８４，８５がそれぞれ積層方向に通じる関係に形成されている。

【００４１】そして、燃料極側集電板６９に設けられた燃料ガス供給溝７０は燃料ガスを供給／排出するための孔８０，８１に通じ、酸化剤極側集電板７１に設けられた酸化剤供給溝７２は酸化剤ガスを供給／排出するための孔８４，８５に通じ、冷却板７４に設けられた案内溝７８は冷却水を供給／排出するための孔８２，８３に通じている。

【００４２】このように、この例に係る固体高分子型燃料電池４１では、酸化剤極側集電体７１の酸化剤極６２に接触する面のほぼ長方形の領域Ｄに長方形の長辺に沿って酸化剤ガスを案内する複数の酸化剤供給溝７２を設けているので、各酸化剤供給溝の深さや幅を小さくすることなく、酸化剤ガスの流速を増加させることができ、この結果、酸化剤極６２で発生した生成水を良好に排除できる。

【００４３】すなわち、この例の場合には、酸化剤極６２として短辺１０㎝、長辺２０㎝、電極面積２００㎝^{2}

のものを用いており、酸化剤供給溝７２は幅１㎜、深さ０．５㎜、長さ２０㎝、２㎜ピッチで５０本設けている。今、電流密度を０．４Ａ／㎠ とし、空気利用率を４０％ とし、酸化剤ガス（空気）供給圧力を１atm とすると、各酸化剤供給溝７２を流れる酸化剤ガスの流速は、３００cm/secとなる。一方、同じ電極面積２００㎠ で正方形の電極（一辺の長さ１４㎝）を用い、同じ溝幅、溝深さ、配設ピッチの酸化剤供給溝を設け、同じ条件で酸化剤ガスを供給した場合、各酸化剤供給溝を流れる酸化剤ガスの流速は２１０cm/secとなる。このように、本例では同じ電極面積でありながら酸化剤ガスの流速を１．５倍に増加させることができる。したがって、生成水の排出を良好に行うことができる。この結果、生成水が酸化剤極６２内に滞留して酸化剤ガスの供給を妨げることがなくなり、長時間に亙って電池性能を維持させることができる。

【００４４】また、このように酸化剤極６２および燃料極６１を長方形に形成できることは、単位セル４２の平面形状も長方形に形成できることになり、燃料電池積層体の積層方向と直交する断面積も長方形に形成できることになる。すなわち、必要な電極面積を確保した状態で燃料電池積層体を偏平に近い形状に形成できることになるので、たとえば電気自動車等のように高さの低い設置空間しか持たない対象にも対応することが可能となる。

【００４５】また、上記例では、燃料極６１および酸化剤極６２の高分子電解質膜６０に接触する領域のエッジ部分Ａ，Ｂが高分子電解質膜６０を挟んで重合しないように燃料極６１および酸化剤極６２を形成している。したがって、高分子電解質膜６０には両エッジ部分Ａ，Ｂよって挟まれる部分が存在しないことになる。このため、膜電極複合体をプレス成形するときは勿論こと、発電時のセル締め付けに際しても上述したエッジ部分Ａ，Ｂの存在によって高分子電解質膜６０が破損するのを防止することが可能となる。

【００４６】図９には、この例に係る単位セルと従来例の単位セルとを用い、性能を比較するための発電試験を行った結果が示されている。従来例の単位セルでは約２０００時間でセル電圧が０．２Ｖまで低下したが、この例に係る単位セルでは４０００時間を越えてもセル電圧の低下はみられなかった。

【００４７】さらに、スクリーン印刷機により、電極の周辺部が額縁状補強シート６５，６６の厚みだけ薄くなるようなスクリーンパターンを用いて製作した燃料極および酸化剤極を用いて発電試験を行ったところ、図９に示す特性と同等の結果を得た。　また、上記例では加湿水透過板７３を導電性の非焼結部材、導電材料を含む多孔質構造のフッ素系樹脂材料の薄板と細孔を備えた金属板で形成しているので、孔径や細孔容量のコントロールが極めて容易で、この結果、高分子電解質膜６０に加湿水を均一に供給することができる。

【００４８】すなわち、図１０には上記例に係る単位セルを５段積層した５セル積層電池の発電試験結果が示されており、図１１には従来例の単位セルを５段積層した５セル積層電池の発電試験結果が示されている。

【００４９】従来例の単位セルを用いた積層電池では、発電開始直後から各セル毎にセル電圧がばらつき、５０００時間後でもセル電圧はばらついたままであり、さらに平均０．１２Ｖ低下した。しかし、本例に係る単位セルを用いた積層電池では、発電開始直後からセル電圧が揃っており、５０００時間後でもセル電圧のばらつきや低下はみられなかった。さらに、加湿水透過板７３として、１００メッシュ、線径８５μmのメツシユ構造のフッ素樹脂系シートとカーボンとを３０％複合したものと、中央の１０cm×１０㎝の領域にエッチング加工で１０μmの細孔を３００個設けたステンレスの薄板とを用いて上記の発電試験を行ったところ、双方とも同等の結果を得た。これらは、高分子電解質膜６０に加湿水を均一に供給することができたことによる。

【００５０】なお、本発明は上述した例に限定されるものではなく種々変形できる。すなわち、上記例では、燃料極６１の大きさと酸化剤極６２の大きさとを同じにしているが、図１２に示すように異ならせてもよい。

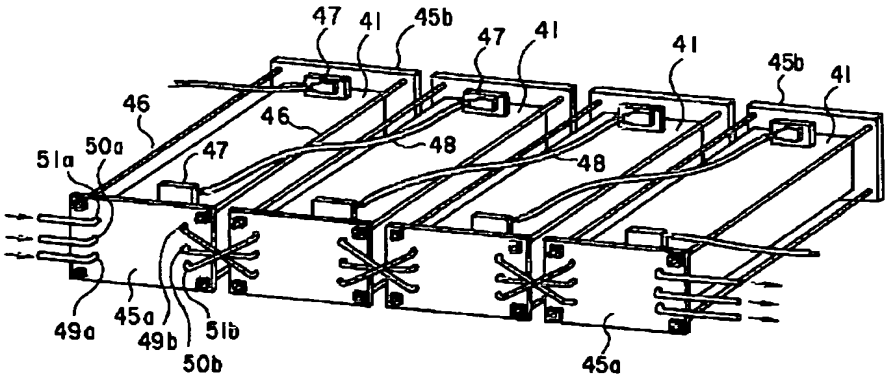
【００５１】また、図１３に示すように、高分子電解質膜６０の面積を燃料極６１または酸化剤極６２の大きさと同じにし、その外側にフッ素樹脂系シートなどで額縁状に形成されたシール材９１を配置してもよい。さらに、図１４に示すように、単に燃料極６１と酸化剤極６２の大きさだけを変えた構成でもよい。

【００５２】また、加湿水透過板の構成も上述した例に限られるものではなく、図１５に示すように、冷却板の冷却水案内溝の設けられている領域に対応する部分がメッシュ構造であるフッ素樹脂系シートとカーボンとを複合化した部材９２で形成され、その回りがフッ素樹脂系シートなどの部材９３で形成された加湿水透過板７３ａを用いてもよい。

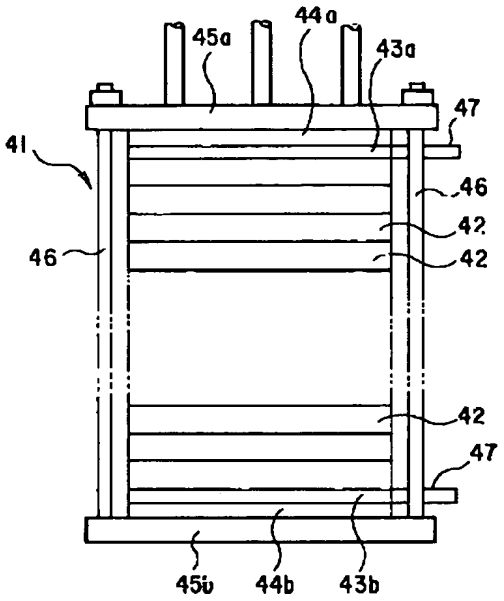
【００５３】さらに、図１６に示すように、加湿水透過板７３ｂをステンレスの薄板９４で形成し、この薄板９４の冷却水案内溝上に位置する部分に孔径の異なる細孔９５を設けたものを用いてもよい。この例では冷却水案内溝長を３つに区分けし、上流に位置している１／３の領域には１５μm、中流に位置している１／３の領域には１０μm、下流に位置している１／３の領域には５μmの細孔９５を設け、細孔の径を上流から下流に進むにしたがって小さくしている。このような構成の加湿水透過板７３ｂを用いると、生成水によって加湿量が過剰になりやすい下流部への加湿水供給量をコントロールすることができる。なお、金属板への細孔の形成はエッチング加工、レーザ加工、放電加工、ドリル加工等によって形成できる。また、加湿水透過板の厚みは０．５㎜以下であることが好ましい。

【００５４】
【発明の効果】以上説明したように、本発明によれば、寿命を大幅に向上させることができる。
【図面の簡単な説明】
【図１】本発明の一実施形態に係る固体高分子型燃料電池の実装形態の一例を示す斜視図
【図２】同固体高分子型燃料電池の側面図
【図３】同固体高分子型燃料電池に組み込まれた単位セルの分解斜視図
【図４】同単位セルに組み込まれた酸化剤極側集電板の一表面を示す図
【図５】同単位セルに組み込まれた燃料極側集電板の一表面を示す図
【図６】同単位セルの縦断面図
【図７】同単位セルの要部の分解断面図
【図８】同単位セルに組み込まれた加湿水透過板の分解斜視図
【図９】同単位セルの発電特性を従来例と比較して示す図
【図１０】同固体高分子型燃料電池の発電特性を示す図
【図１１】従来の固体高分子型燃料電池の発電特性を示す図
【図１２】本発明の変形例を説明するための図
【図１３】本発明の別の変形例を説明するための図
【図１４】本発明のさらに別の変形例を説明するための図
【図１５】本発明の異なる変形例を説明するための図
【図１６】本発明のさらに異なる変形例を説明するための図
【図１７】従来の固体高分子型燃料電池に組み込まれた単位セルの縦断面図
【図１８】同単位セルに組み込まれた燃料極側集電板の一表面を示す図
【符号の説明】
４１…固体高分子型燃料電池
４２…単位セル
４９ａ…燃料ガス供給マニホールド
４９ｂ…燃料ガス排出マニホールド
５０ａ…給水マニホールド
５０ｂ…排水マニホールド
５１ａ…酸化剤ガス供給マニホールド
５１ｂ…酸化剤ガス排出マニホールド
６０…高分子電解質膜
６１…燃料極
６２…酸化剤極
６３，６４…凸部
６５，６６…額縁状補強シート
６７，６８…シール材
６９…燃料極側集電板
７０…燃料供給溝
７１…酸化剤極側集電板
７２…酸化剤供給溝
７３，７３ａ，７３ｂ…加湿水透過板
７４…冷却板
７８…案内溝
Ａ，Ｂ…エッジ部
Ｃ，Ｄ…長方形の領域

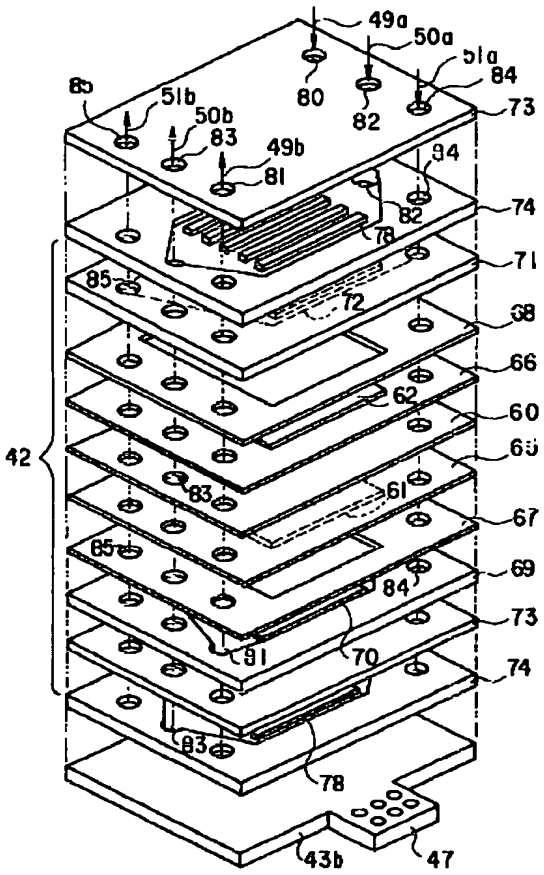
【図１】



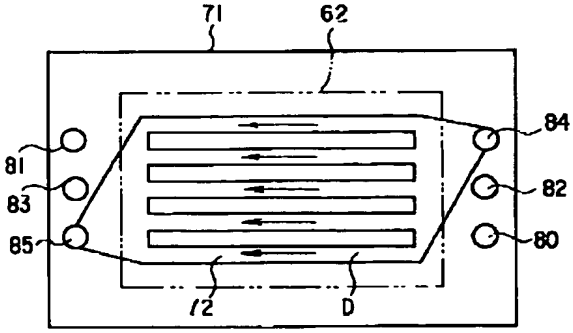
【図2】


45a
44a
43a
47
41
46
42
42
46
42
47
45b
44b
43b

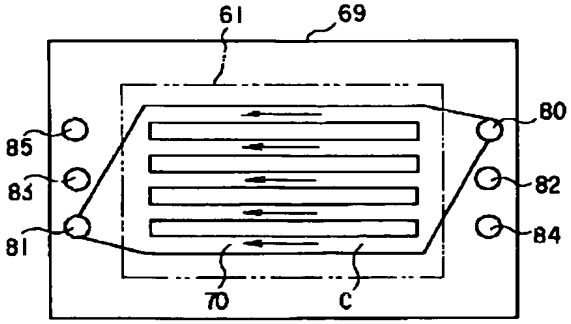
【図3】


49a
50a
51a
84
80
82
73
85
51b
50b
83
49b
81
94
74
82
78
71
85
72
68
66
62
60
42
65
83
61
67
85
69
84
73
91
70
74
83
78
43b
47

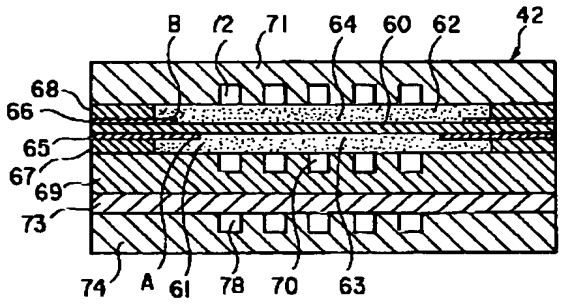
【図4】


71
62
84
81
83
82
85
80
12
D

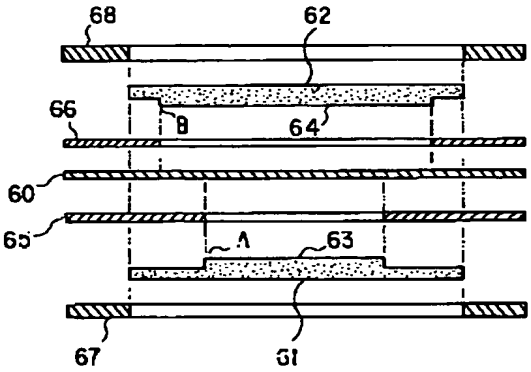
【図5】


61
69
80
85
83
82
81
84
70
C

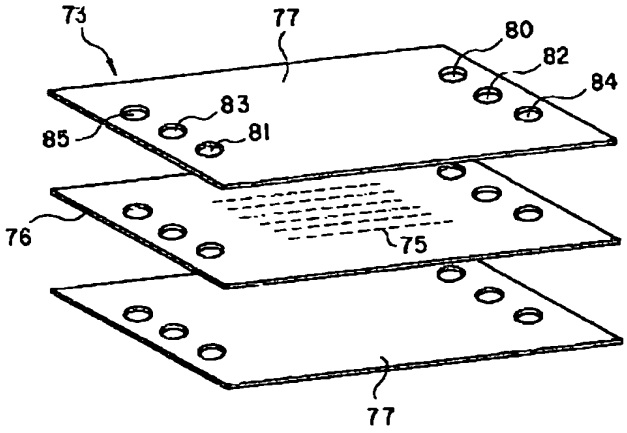
【図6】



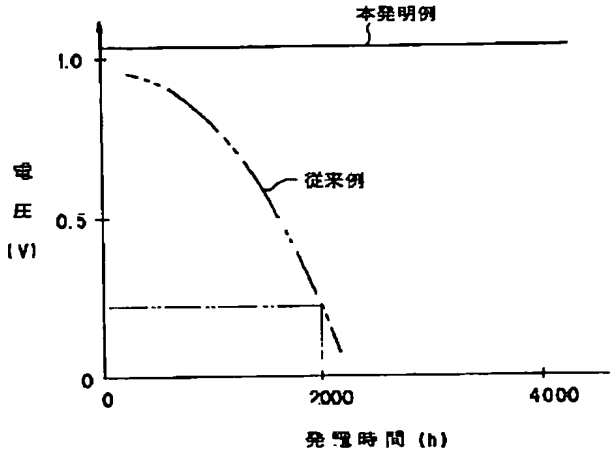
【図7】



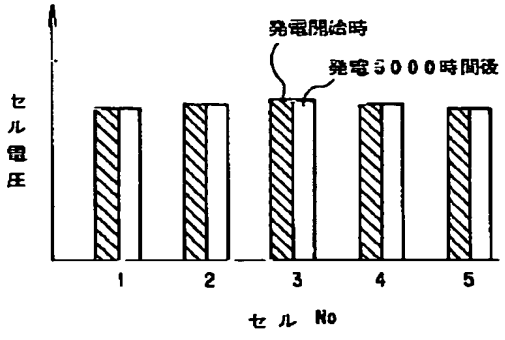
【図8】



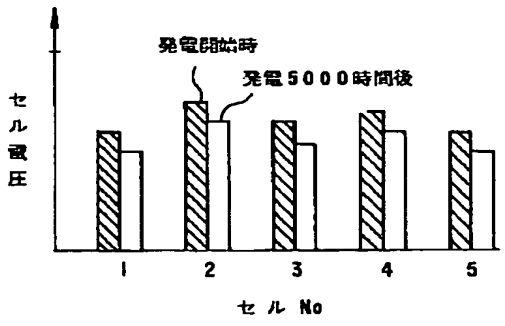
【図9】



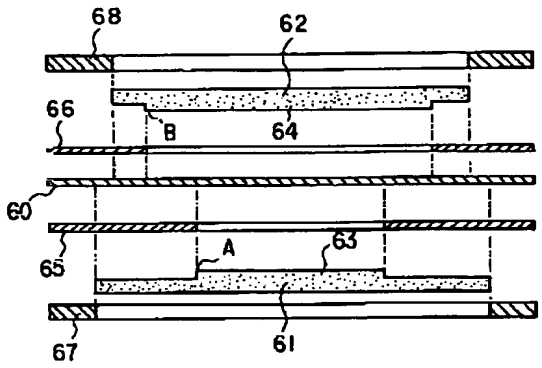
【図10】



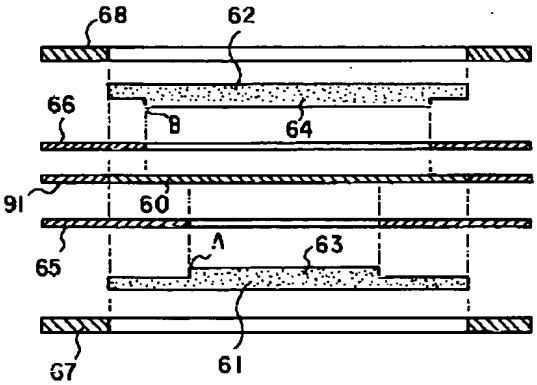
【図11】



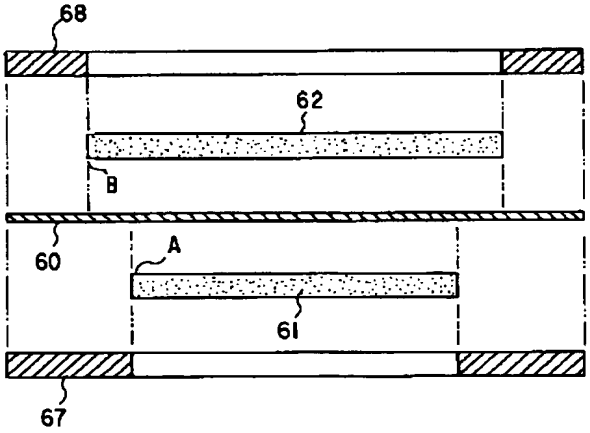
【図１２】



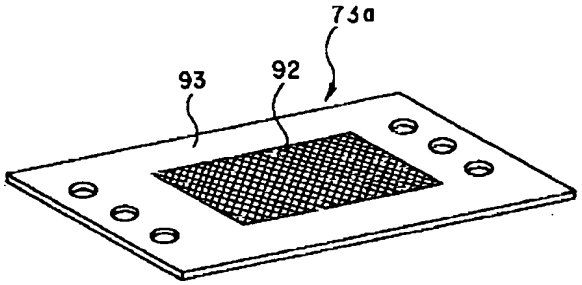
【図１３】



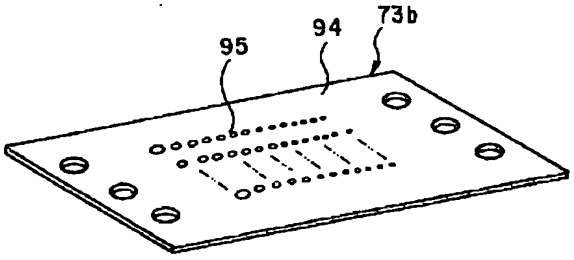
【図１４】



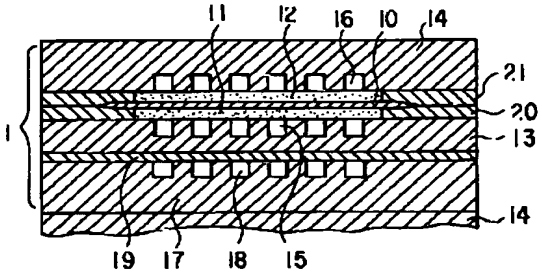
【図１５】



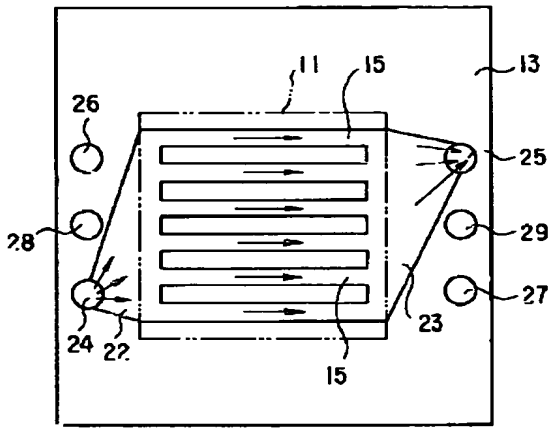
【図１６】



【図１７】



【図１８】



フロントページの続き

(51)Int.Cl.⁶		識別記号	FI		
H01M	8/10		H01M	8/10	
	8/24			8/24	R

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-172587
(43)Date of publication of application : 26.06.1998

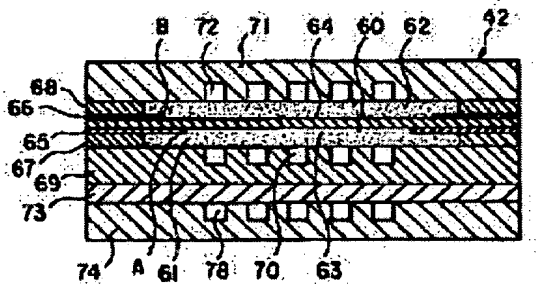
(51)Int.Cl. H01M 8/02
H01M 8/04
H01M 8/10
H01M 8/24

(21)Application number : 08-326733
(22)Date of filing : 06.12.1996

(71)Applicant : TOSHIBA CORP
(72)Inventor : MUKU YOSHIHARU
MUNEUCHI ATSUO
SHIMOTORI SOICHIRO

(54) SOLID HIGHPOLYMER TYPE FUEL CELL

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a solid highpolymer type fuel cell which can be equipped with a long lifetime.
SOLUTION: A solid highpolymer type fuel cell includes unit cells 42 in which a fuel electrode 61 and oxidator electrode 62 are arranged in such a way as pinching a highpolymer electrolyte film 60, wherein the two electrodes 61 and 62 are formed as not overlapping while their edge parts A and B in the regions contacting with the electrolyte film 60 are pinching the film 60.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell including two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, A polymer electrolyte fuel cell, wherein said two or more oxidizer supply grooves are provided that a rectangular field should be covered mostly and oxidant gas should be guided along a long side of the above-mentioned rectangle into a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector.
[Claim 2]The polymer electrolyte fuel cell according to claim 1, wherein said two or more fuel-supply slots are provided that it should show fuel gas along a long side of the above-mentioned rectangle in a field in contact with said fuel electrode of said fuel electrode side collector to a field which counters a field of said rectangle.
[Claim 3]The polymer electrolyte fuel cell according to claim 1, wherein an internal manifold for supplying said fuel gas and said oxidant gas to said unit cell is provided in the outside of a field of the above-mentioned rectangle by the shorter side side in a field of said rectangle.
[Claim 4]Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell containing two or more oxidizer supply groove **** which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, A polymer electrolyte fuel cell, wherein said fuel electrode and said oxidizing agent pole are formed in shape in which an edge part of a field in contact with said each polymer electrolyte membrane does not polymerize on both sides of the above-mentioned polymer electrolyte membrane.
[Claim 5]The polymer electrolyte fuel cell according to claim 4, wherein area in contact with said polymer electrolyte membrane differs between said fuel electrode and said oxidizing agent pole.
[Claim 6]Heights which form a field in contact with said polymer electrolyte membrane in said fuel electrode and said oxidizing agent pole are formed, respectively, The polymer electrolyte fuel cell according to claim 4, wherein it is equipped with frame shape reinforcement sheets formed in

the almost same thickness as height of the above-mentioned heights so that these heights might be surrounded.
[Claim 7]Said frame shape reinforcement sheets are polymer electrolyte fuel cells to a description in Claim 6 currently forming with the same material as said polymer electrolyte membrane.
[Claim 8]Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, Two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, A cold plate to which it is provided in the back side of said fuel electrode side collector, and shows cooling water, In a polymer electrolyte fuel cell provided with a unit cell containing a humidifying water transparent plate which controls quantity in which some water which it was provided between this cold plate and said fuel electrode side collector, and was shown by the above-mentioned cold plate shifts to the above-mentioned fuel electrode side collector, A polymer electrolyte fuel cell, wherein said humidifying water transparent plate is formed by a conductive non-sintering member.
[Claim 9]The polymer electrolyte fuel cell according to claim 8, wherein said humidifying water transparent plate is formed with sheet metal of fluororesin material of porous structure containing an electrical conducting material.
[Claim 10]The polymer electrolyte fuel cell according to claim 8 with which said humidifying water transparent plate is characterized by a monotonous and formed thing in which a hole from which a size differs was drilled.
[Claim 11]A polymer electrolyte fuel cell, wherein between said layered products which are installed side by side in the direction characterized by comprising the following the direction and a layered product which carried out the plural laminates of the unit cell cross at right angles to a laminating direction of said unit cell, and adjoin is electrically connected in series. [two or more]
Polymer electrolyte membrane.
A fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual.
A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode.
Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of the oxidizing agent pole side charge collector by which contact arrangement was carried out, and said fuel electrode side collector at the back of said oxidizing agent pole, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, Two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the polymer electrolyte fuel cell using the composite of the inorganic matter which has the poly membrane or hydrogen ion conductivity which has hydrogen ion conductivity or organic-materials powder, and the polymer material as a binder as an electrolyte.
[0002]
[Description of the Prior Art]In recent years, the fuel cell attracts attention as an efficient energy converting device. A fuel cell is divided roughly into low temperature operation fuel cells, such as an alkali type, a solid polymer type, and a phosphoric acid type, and elevated-temperature operating fuel cells, such as a melting carbonate type and a solid oxide type, by the kind of electrolyte to be used, for example.
[0003]Among these, since high power density is obtained with a compact structure and it can moreover operate by a simple system, the polymer electrolyte fuel cell (PEFC) using the polymer electrolyte membrane which has ion conductivity as an electrolyte attracts attention as power supplies the object for the universes, the object for a detached island, the constant object for grounds, for vehicles, etc.
[0004]What graft-ized trifluoroethylene to the cation exchange membrane of a polystyrene system with a sulfonic group, the mixture of fluorocarbon sulfonic acid and polyvinylidene fluoride, and the fluorocarbon matrix, and was added to them as polymer electrolyte membrane is known. These days, the perfluorocarbon-sulfonic-acid film (for example, Nafion: a trade name, the Du Pont make) etc. are used.
[0005]The polymer electrolyte fuel cell using such polymer electrolyte membrane as an electrolyte is constituted as a layered product structure which carried out the plural laminates of the unit cell 1 usually formed as shown in drawing 17.
[0006]The fuel electrode 11 and the oxidizing agent pole 12 which have been arranged so that the unit cell 1 may be formed by the porous body which supported the polymer electrolyte membrane 10 and the catalyst of platinum etc. and the polymer electrolyte membrane 10 may be pinched by mutual, The fuel electrode side collector 13 made from a porous body by which contact arrangement was carried out at the back of the fuel electrode 11, Two or more fuel-supply slots 15 which are formed in the field in contact with the fuel electrode 11 of the oxidizing agent pole side charge collector 14 by which contact arrangement was carried out, and the fuel electrode side collector 13 at the back of the oxidizing agent pole 12, and carry out distribution supply of the fuel gas at the fuel electrode 11, Two or more oxidizer supply grooves 16 which are formed in the field in contact with the oxidizing agent pole 12 of the oxidizing agent pole side charge collector 14, and carry out distribution supply of the oxidant gas in the oxidizing agent pole 12, It comprises the cold plate 17 formed in the back side of the fuel electrode side collector 13, the cooling water guide rail 18 to which it is provided in this cold plate 17, and shows cooling water, and the humidifying water transparent plate 19 with which some water shown by this cooling water guide rail 18 controls the quantity which shifts to the fuel electrode side collector 13.

[0007]The inside of drawing 17, and 20 and 21, While surrounding the circumference of the membrane electrode complex which consists of the polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 and preventing disclosure of fuel gas and oxidant gas, the frame shape spacer which secures the insulation between the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 is shown. When not making the cold plate 17 intervene, the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 may be unified.
[0008]The polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 are formed in the sheet shaped.
The thickness is formed in 1 mm or less for internal resistance reduction.
The polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 are formed in the square in consideration of productivity in many cases. And the area is decided by the current value required for power generation, and the current value per unit area, i.e., current density, and there is in general much more than 100 cm^2, i.e., the thing by which one side is set as 10 cm or more.
[0009]As the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 are shown in drawing 18 on behalf of the fuel electrode side collector 13, are formed in the square by many according to the shape of the polymer electrolyte membrane 10 or each poles 11 and 12. And according to the shape of each poles 11 and 12, the square field was set as the center section, and the fuel gas supply groove 15 (oxidant gas supply groove 16) is established in two or more parallel to the field of this square. The same might be said of the cold plate 17, the square field was set as the center section according to the shape of each poles 11 and 12, and the cooling water guide rail 18 is established in two or more parallel to the field of this square.
[0010]The both ends of the fuel gas supply groove 15 lead to the fuel gas supply manifold 24 and the fuel gas exhaust manifold 25 which were provided in the edge part of the lamination element in the laminating direction via the interconnecting catwalks 22 and 23 formed in the respectively almost same depth as the fuel gas supply groove 15. Similarly, the both ends of the oxidant gas supply groove 16 lead to the oxidant gas supply manifold 26 and the oxidant gas exhaust manifold 27, and the both ends of the cooling water guide rail 18 lead to the cooling water supply manifold 28 and the cooling-water-discharge manifold 29. On the other hand, the humidifying water transparent plate 19 is formed with the conductive porosity sheet metal which sintered and obtained metal powder or the carbon powder of hydrophilic nature.
[0011]Less than 1V and since the electromotive force of the unit cell 1 constituted in this way is small, two or more unit cells are laminated, and he connects in series, and is trying to acquire required electromotive force. However, if it was in the conventional polymer electrolyte fuel cell constituted as mentioned above, there were the following problems.
[0012]That is, if a cell reaction is made to perform, supplying the oxidant gas containing oxygen to the oxidizing agent pole 12 while supplying the fuel gas which contains hydrogen in the fuel electrode 11, it will be generated by water in the oxidizing agent pole 12 side as a by-product of this cell reaction. This water is called produced water. If this produced water exists so much, it will become the hindrance of supply of oxidant gas. Therefore, it is necessary to eliminate produced water outside promptly. Produced water shifts to the oxidant gas supply groove 16 easily. For this reason, generally, oxidant gas is supplied superfluously and the method of discharging with unreacted oxidant gas is taken. In this method, the rate of flow of oxidant gas serves as an important parameter with the flow of superfluous oxidant gas. That is, many produced water can be discharged, so that the rate of flow is early.
[0013]However, since the square field was set as the center section of the oxidizing agent pole side charge collector 14 formed in the square in the conventional polymer electrolyte fuel cell and the oxidant gas supply groove 16 is established in two or more parallel to the field of this square, It was difficult to raise the rate of flow of oxidant gas, and it difficult to lengthen the life of a cell.
[0014]In order to raise the rate of flow of oxidant gas, the cross-section area, i.e., the tooth depth, and width of each oxidant gas supply groove 16 are realizable by making it small, but when

the area of an electrode is small, realization becomes difficult from a point of process tolerance.
[0015]If it is in the conventional polymer electrolyte fuel cell, the fuel electrode 11 and the oxidizing agent pole 12 are formed in an identical size and an identical area. For this reason, it becomes that with which the edge part of the field in contact with the edge part of a field in contact with the polymer electrolyte membrane 10 of the fuel electrode 11 and the polymer electrolyte membrane 10 of the oxidizing agent pole 12 lapped on both sides of the polymer electrolyte membrane 10, When carrying out press forming of the membrane electrode complex which consists of the polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12, the pressure concentrated on the edge part, and there was a possibility that the portion in contact with the above-mentioned edge part of the polymer electrolyte membrane 10 might be pushed from both, and might be damaged. In the time of power generation, when the portion pinched by both the above-mentioned edge parts of the polymer electrolyte membrane 10 is in the state where mechanical stress has always started and prolonged operation was performed by bolting of a cell, the portion pinched by both the above-mentioned edge parts of the polymer electrolyte membrane 10 may have deteriorated and damaged it.
[0016]If it is in the conventional polymer electrolyte fuel cell, the humidifying water transparent plate 19 which sintered and obtained metal powder or carbon powder is used. In such a sintered compact, it is easy to produce a difference in porous structure by the conditions of sintering. Control of an aperture uniform at the time of sintering or fine-pores capacity is difficult. For this reason, also in the same humidifying water transparent plate 19, the aperture and fine-pores capacity of each part show dispersion, and an aperture and fine-pores capacity show dispersion about every sheet of the humidifying water transparent plate 19 further. With such dispersion, the humidifying water supplied to the polymer electrolyte membrane 10 became uneven, and the problem which becomes unstable also had battery capacity.
[0017]Although it is thin for miniaturization of a cell and a thing with a mechanical strength is needed, in the conventional manufacturing method which sinters powder, the thickness of about 1 mm of outlines is needed. Since it is a porous body of metal or carbon, if it is made thin, a mechanical strength will be lost, after all, with the conventional humidifying water transparent plate, it can be thin, a thing with a mechanical strength cannot be manufactured, and a compact cell cannot be realized.
[0018]
[Problem(s) to be Solved by the Invention]If it was in the conventional polymer electrolyte fuel cell like ****, prompt discharge of produced water was difficult, moreover big mechanical stress was easily added to polymer electrolyte membrane, and there was a problem that the life as a cell was short, for the Reason of being unable to supply water to polymer electrolyte membrane good moreover. Then, an object of this invention is to provide a compact polymer electrolyte fuel cell, while raising a life remarkably.
[0019]
[Means for Solving the Problem]To achieve the above objects, in an invention concerning Claim 1. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell including two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, It is characterized by providing said two or more oxidizer supply grooves that a rectangular field should be covered mostly and oxidant gas should be guided along a long side of the above-mentioned rectangle into a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector.
[0020]In an invention concerning Claim 1, said two or more fuel-supply slots may be provided

that it should show fuel gas along a long side of the above-mentioned rectangle in a field in contact with said fuel electrode of said fuel electrode side collector to a field which counters a field of said rectangle.

[0021]In an invention concerning Claim 1, it is still better to provide an internal manifold for supplying said fuel gas and said oxidant gas to said unit cell in the outside of a rectangular field by the shorter side side in a field of said rectangle.

[0022]To achieve the above objects, in an invention concerning Claim 4. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell containing two or more oxidizer supply groove **** which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, Said fuel electrode and said oxidizing agent pole are characterized by forming an edge part of a field in contact with said each polymer electrolyte membrane in shape which does not polymerize on both sides of the above-mentioned polymer electrolyte membrane.

[0023]In an invention of Claim 4, area in contact with polymer electrolyte membrane may differ between said fuel electrode and said oxidizing agent pole. In an invention of Claim 4, heights which form a field in contact with said polymer electrolyte membrane are formed in said fuel electrode and said oxidizing agent pole, respectively, and it may be equipped with frame shape reinforcement sheets formed in the almost same thickness as height of the above-mentioned heights so that these heights might be surrounded. And said frame shape reinforcement sheets may be formed with the same material as said polymer electrolyte membrane.

[0024]To achieve the above objects, in an invention concerning Claim 8. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, Two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, A cold plate to which it is provided in the back side of said fuel electrode side collector, and shows cooling water, In a polymer electrolyte fuel cell provided with a unit cell containing a humidifying water transparent plate which controls quantity in which some water which it was provided between this cold plate and said fuel electrode side collector, and was shown by the above-mentioned cold plate shifts to the above-mentioned fuel electrode side collector, Said humidifying water transparent plate is characterized by being formed by a conductive non-sintering member.

[0025]in an invention concerning Claim 8, a hole which may be formed with sheet metal of fluororesin material of porous structure in which said humidifying water transparent plate includes an electrical conducting material and from which it carries out and a size differs was formed -- it is monotonous and may be formed.

[0026]Since it has provided that it should show oxidant gas to a rectangular field along a long side of the above-mentioned rectangle in an invention concerning Claim 1 almost covering a field which contacts an oxidizing agent pole of the oxidizing agent pole side charge collector in two or more oxidizer supply grooves, Without making small the depth and width of each oxidizer supply groove (i.e., without it causes difficult-ization of manufacture), the rate of flow of oxidant gas can be made to increase, and, as a result, produced water can be eliminated good.

[0027]That is, it thinks on the basis of area of a fuel electrode (oxidizing agent pole) now. Like the above-mentioned, area of an electrode shall be decided by current density and shall be 100 cm^2 necessity temporarily. Since a square electrode is used in the conventional polymer electrolyte fuel cell, one side is set to 10 cm. On the other hand, in an invention concerning Claim 1, since two or more oxidizer supply grooves are established in a rectangular field almost covering a field in contact with an oxidizing agent pole of the oxidizing agent pole side charge collector, it is not necessary to form an electrode in a square. For example, it may form in a rectangle whose shorter side is 7 cm and whose long side is 14.3 cm. And in an invention concerning Claim 1, an oxidizer supply groove is provided so that oxidant gas may be guided along a rectangular long side. Therefore, when it compares the same [a tooth depth a flute width, and an allocation pitch], there will be few numbers of a slot at an invention which relates to Claim 1 compared with the former. Supposing a supply pressure of oxidant gas is constant, only a part with few numbers of an oxidizer supply groove can make the rate of flow of oxidant gas which carries out conduction of the inside of an oxidizer supply groove increase. Therefore, produced water can be eliminated good.
[0028]That an electrode can be formed in a rectangle in this way can form in a rectangle plane shape of a unit cell, and a cross-section area which can form in a rectangle and intersects perpendicularly with a laminating direction of a fuel cell layered product. That is, since a fuel cell layered product can be flatly formed in near shape where a required electrode area is secured, it becomes possible to correspond also to an object which has only installation space where height is low, for example like an electromobile.
[0029]In an invention concerning Claim 4, a fuel electrode and an oxidizing agent pole are formed so that an edge part of a field in contact with polymer electrolyte membrane of a fuel electrode and an oxidizing agent pole may not polymerize on both sides of polymer electrolyte membrane. therefore -- polymer electrolyte membrane -- both edge parts -- a portion pinched will not exist. For this reason, when carrying out press forming of the membrane electrode complex, it becomes possible to prevent polymer electrolyte membrane from being damaged by existence of an edge part mentioned above even if it, of course, faced things and cell bolting at the time of power generation.
[0030]Since a humidifying water transparent plate is formed in an invention concerning Claim 8 with a plate with which sheet metal of a conductive non-sintering member, for example, fluororesin material of porous structure containing an electrical conducting material, and fine pores were formed, control of an aperture or fine-pores capacity is very easy. Therefore, it becomes possible to supply humidifying water to polymer electrolyte membrane uniformly.
[0031]
[Embodiment of the Invention]Hereafter, the embodiment of this invention is described, referring to Drawings. The perspective view of the polymer electrolyte fuel cell built over drawing 1 at one embodiment of this invention and the example which connected the polymer electrolyte fuel cell 41 to four-piece series here, and constituted the power supply for electromobiles is shown.
[0032]Each polymer electrolyte fuel cell 41 carries out the plural laminates of the unit cell 42, as shown in drawing 2, The plate conducting 43a and 43b, the electric insulating plates 44a and 44b, and the end plates 45a and 45b of reliance are in the both ends of this layered product, respectively, and it has become what bound tight between 4 corner positions of the end plates 45a and 45b using the insulation rod 46, and was unified in this state.
[0033]The section where the laminating direction and each polymer electrolyte fuel cell 41 constituted in this way crosses at right angles is formed in the rectangle. And a shorter side and a shorter side are made to adjoin, [in / for the four polymer electrolyte fuel cells 41 / the section] It installed in the direction which intersects perpendicularly to the direction by which the unit cell 42 is laminated side by side, and between the layered products which connect the boss bar 47 which protruded on the plate conducting 43a and 43b with the lead 48, and adjoin is electrically connected in series. Thus, the overall height of the space in which a power supply is installed can be made low, and it enables it to install in the space where the height of the under floor of a car, etc. is low by arranging the polymer electrolyte fuel cell 41.

[0034]In each polymer electrolyte fuel cell 41, like the conventional cell, fuel gas required for power generation, The fuel gas supply manifold 49a for supplying and discharging oxidant gas and cooling water, the fuel gas exhaust manifold 49b, The feed water manifold 50a, the drain manifold 50b, the oxidant gas supply manifold 51a, and the oxidant gas exhaust manifold 51b are formed in the laminating direction. In this example, the manifolds to which the adjoining polymer electrolyte fuel cell 41 corresponds are connected in series. Of course, it can also supply in parallel.
[0035]The exploded perspective view of the unit cell 42 is shown in drawing 3. The unit cell 42 is provided with the polymer electrolyte membrane 60 formed with the same construction material as a publicly known thing. This polymer electrolyte membrane 60 is a thing about 0.18 mm thick, Contact arrangement of the fuel electrode 61 and the oxidizing agent pole 62 which were formed in the rectangle (for example, 10 cm of shorter sides, 20 cm of long sides, electrode area 200 cm^2) so that a shorter side might be located in the side by which the manifold is formed in both sides in an area smaller than polymer electrolyte membrane is carried out. The fuel electrode 61 and the oxidizing agent pole 62 are what applied the carbon particle having contained platinum, and are formed in the 0.4-mm-thick surface of the porous body made from carbon.
[0036]The heights 63 which specify the field (area) of the rectangle which contacts the polymer electrolyte membrane 60 as shown in drawing 6 and drawing 7 in the fuel electrode 61 are formed. The heights 64 which specify the field of the rectangle which similarly contacts the polymer electrolyte membrane 60 as shown in drawing 6 and drawing 7 also in the oxidizing agent pole 62 are formed. Unlike the area of the heights 63, the area of the heights 64 is set as size here. That is, edge part A of the heights 63 and edge part B of the heights 64 have an area relation which does not lap with a laminating direction on both sides of the polymer electrolyte membrane 60. Specifically, edge part B has an area relation located in the 2-5-mm outside from edge part A. And it is equipped with the frame shape reinforcement sheets 65 formed in the sheet shape of the almost same thickness as the height of the heights 63 with the same construction material as the fluoro-resin system sheet of the almost same thickness as the height of the heights 63, or the polymer electrolyte membrane 60 so that the heights 63 formed in the fuel electrode 61 may be surrounded. It is equipped with the frame shape reinforcement sheets 65 which similarly were formed in the same sheet shape also as the circumference of the heights 64 formed in the oxidizing agent pole 62. The sealants 67 and 68 formed in frame shape with insulation sheets, such as fluorocarbon rubber with the almost same thickness as these peripheral parts, are arranged at the peripheral part of the fuel electrode 61 and the oxidizing agent pole 62.
[0037]Contact arrangement of the fuel electrode side collecting electrode plate 69 which exhibits the supply function of fuel gas and current collection function to the fuel electrode 61 is carried out at the back side [of the fuel electrode 61], i.e., drawing 3 of fuel electrode 61, and drawing 6 Nakashita side side. This fuel electrode side collecting electrode plate 69 is formed with the carbon porous plate of hydrophilic nature. In the contact surface with the fuel electrode 61 in the fuel electrode side collecting electrode plate 69, as shown also in drawing 5 and drawing 6, two or more fuel-supply slots 70 for supplying fuel gas to the fuel electrode 61 are formed at the relation prolonged in the direction which meets the long side of the fuel electrode 61 to the field C of a rectangle smaller than the area of the fuel electrode 61. The 50 fuel-supply slots 70 are established, for example in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. Similarly, contact arrangement of the oxidizing agent pole side collecting electrode plate 71 which exhibits the supply function of oxidant gas and current collection function to the oxidizing agent pole 62 is carried out at the drawing 3 [by the side of / 62 / the back of the oxidizing agent pole 62 (i.e., an oxidizing agent pole)], and drawing 6 Nakagami side side. This oxidizing agent pole side collecting electrode plate 71 is formed with the precise carbon plate. In a contact surface with the oxidizing agent pole 62 in the oxidizing agent pole side collecting electrode plate 71, As shown in drawing 4 and drawing 6, two or more oxidizer supply grooves 72 for supplying oxidant gas to the oxidizing agent pole 62 are formed in the relation prolonged in the direction which meets the long side of the oxidizing agent pole 62 to the field D of a rectangle smaller than the area of the oxidizing agent pole 62. For example, 50 of this oxidizer

supply groove 72 are provided in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. Drawing 4 is shown as a figure which looked at the oxidizing agent pole side collecting electrode plate 71 from the bottom in drawing 3.

[0038]Contact arrangement of the humidifying water transparent plate 73 is carried out at the drawing 3 [of the fuel electrode side collecting electrode plate 69], and drawing 6 Nakashita side side, and contact arrangement of the cold plate 74 is carried out at the drawing 3 [of this humidifying water transparent plate 73], and drawing 6 Nakashita side side. The humidifying water transparent plate 73 so that it may be shown in the non-sintering board which has conductivity, for example, drawing 8, To both sides of the stainless sheet metal 76 which formed hundreds of fine pores 75 with the aperture of 10 micrometers in the region disposing of the fuel gas supply groove 70, and the field which counters. It is a thing with a thickness of 0.16 mm which has arranged the sheet metal 77 in which carbon was made to mix 30% on the porosity fluoro-resin system sheet of 10 micrometers in an aperture, and 70% of fine-pores capacity, and was united with it, and is formed.

[0039]The cold plate 74 is formed with a precise carbon plate or metal plate. Two or more guide rails 78 for showing cooling water to the field located in the humidifying water transparent plate 73 side of the cold plate 74 are formed in the region disposing of the fuel gas supply groove 70, and the field which counters in parallel with the fuel gas supply groove 70.

[0040]Both the short side parts of the polymer electrolyte membrane 60, the frame shape reinforcement sheets 65 and 66, the sealants 67 and 68, the fuel electrode side collecting electrode plate 69, the oxidizing agent pole side collecting electrode plate 71, the humidifying water transparent plate 73, and the cold plate 74 (by the shorter side side of the rectangular fields C and D.) And out of the field of the above-mentioned rectangle, The holes 82 and 83, the oxidant gas supply manifold 51a, and the oxidant gas exhaust manifold 51b which constitute the holes 80 and 81, the feed water manifold 50a, and the drain manifold 50b which constitute the fuel gas supply manifold 49a and the fuel gas exhaust manifold 49b. The holes 84 and 85 to constitute are formed in the relation which leads to a laminating direction, respectively.

[0041]And the fuel gas supply groove 70 established in the fuel electrode side collecting electrode plate 69 leads to the holes 80 and 81 for supplying / discharging fuel gas, The oxidizer supply groove 72 established in the oxidizing agent pole side collecting electrode plate 71 leads to the holes 82 and 83 for the guide rail 78 established in the cold plate 74 to supply / discharge cooling water through the holes 84 and 85 for supplying / discharging oxidant gas.

[0042]Thus, in the polymer electrolyte fuel cell 41 concerning this example. Since two or more oxidizer supply grooves 72 of the field in contact with the oxidizing agent pole 62 of the oxidizing agent pole side charge collector 71 which show mostly oxidant gas to the rectangular field D along a rectangular long side are formed, The produced water by which could make the rate of flow of oxidant gas increase, and it was generated as a result in the oxidizing agent pole 62 can be eliminated good, without making small the depth and width of each oxidizer supply groove.

[0043]That is, in the case of this example, the thing of 10 cm of shorter sides, 20 cm of long sides, and electrode area 200 cm^2 is used as the oxidizing agent pole 62, and the 50 oxidizer supply grooves 72 are formed in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. If current density is made into 0.4A/cm^2, an air utilization rate is made into 40% now and an oxidant gas (air) supply pressure is set to 1atm, the rate of flow of the oxidant gas which flows through each oxidizer supply groove 72 will be set to sec in 300 cm /. On the other hand, it is a square electrode (14 cm in length of one side) at the same electrode area 200 cm^2. When it uses, the oxidizer supply groove of the same flute width, a channel depth, and an allocation pitch is provided and oxidant gas is supplied on the same conditions, the rate of flow of the oxidant gas which flows through each oxidizer supply groove is set to sec in 210 cm /. Thus, though it is the same electrode area, the rate of flow of oxidant gas can be made to increase by 1.5 times in this example. Therefore, produced water can be discharged good. As a result, it can be lost that produced water stagnates in the oxidizing agent pole 62, and bars supply of oxidant gas, a long time can be covered, and battery capacity can be maintained.

[0044]That the oxidizing agent pole 62 and the fuel electrode 61 can be formed in a rectangle in

this way can form in a rectangle the plane shape of the unit cell 42, and the cross-section area which can form in a rectangle and intersects perpendicularly with the laminating direction of a fuel cell layered product. That is, since a fuel cell layered product can be flatly formed in near shape where a required electrode area is secured, it becomes possible to correspond also to the object which has only the installation space where height is low, for example like an electromobile.

[0045]In the above-mentioned example, the fuel electrode 61 and the oxidizing agent pole 62 are formed so that edge part [of a field] A in contact with the polymer electrolyte membrane 60 of the fuel electrode 61 and the oxidizing agent pole 62 and B may not polymerize on both sides of the polymer electrolyte membrane 60. Therefore, both edge part A and the portion B Depended and pinched will not exist in the polymer electrolyte membrane 60. For this reason, when carrying out press forming of the membrane electrode complex, it becomes possible to prevent the polymer electrolyte membrane 60 from being damaged by existence of edge part A mentioned above even if it, of course, faced things and cell bolting at the time of power generation, and B.

[0046]The result of having done the power generation examination for comparing performance is shown in drawing 9 using the unit cell concerning this example, and the unit cell of a conventional example. Although cell voltage fell to 0.2V by the unit cell of the conventional example in about 2000 hours, even if it exceeded 4000 hours, the fall of cell voltage was not seen by the unit cell concerning this example.

[0047]When the power generation examination was done using the fuel electrode and oxidizing agent pole which the periphery of the electrode manufactured with the screen printer using a screen pattern which becomes thin only the thickness of the frame shape reinforcement sheets 65 and 66, the result equivalent to the characteristic shown in drawing 9 was obtained. Since it forms with the sheet metal of the fluororesin material of the porous structure which includes a conductive non-sintering member and an electrical conducting material for the humidifying water transparent plate 73 in the above-mentioned example, and the metal plate provided with fine pores, Control of an aperture or fine-pores capacity is very easy, and, as a result, can supply humidifying water to the polymer electrolyte membrane 60 uniformly.

[0048]That is, the power generation test result of 5 cell layer built cell which laminated five steps of unit cells concerning the above-mentioned example is shown in drawing 10, and the power generation test result of 5 cell layer built cell which laminated five steps of unit cells of the conventional example is shown in drawing 11.

[0049]With the layer built cell using the unit cell of the conventional example, cell voltage varied for every cell from immediately after the power generation start, and also in 5000 hours, cell voltage has varied and fell by an average of 0.12 morev. However, with the layer built cell using the unit cell concerning this example, cell voltage has gathered from immediately after the power generation start, and neither dispersion in cell voltage nor a fall was seen also in 5000 hours. What compounded 100 meshes, and the fluoro-resin system sheet and carbon of the mesh structure of 85 micrometers of wire sizes 30% as the humidifying water transparent plate 73, When the above-mentioned power generation examination was done on the central field (10 cm x 10 cm) using the stainless sheet metal which provided 300 10-micrometer fine pores by etching processing, both sides obtained the equivalent result. These are because humidifying water was uniformly supplied to the polymer electrolyte membrane 60.

[0050]This invention is not limited to the example mentioned above, and can change variously. That is, although the size of the fuel electrode 61 and the size of the oxidizing agent pole 62 are made the same, it may be made to differ in the above-mentioned example, as shown in drawing 12.

[0051]As shown in drawing 13, area of the polymer electrolyte membrane 60 may be made the same as the size of the fuel electrode 61 or the oxidizing agent pole 62, and the sealant 91 formed in the outside with the fluoro-resin system sheet etc. at frame shape may be arranged. As shown in drawing 14, the composition of having changed only the size of the fuel electrode 61 and the oxidizing agent pole 62 may be used.

[0052]As it is not restricted to the example which the composition of the humidifying water transparent plate also mentioned above and is shown in drawing 15, The humidifying water

transparent plate 73a with which it was formed by the member 92 which composite-ized the fluoro-resin system sheet whose portion corresponding to the field in which the cooling water guide rail of the cold plate is established is mesh structure, and carbon, and the surroundings of it were formed by the members 93, such as a fluoro-resin system sheet, may be used.
[0053]As shown in drawing 16, the humidifying water transparent plate 73b may be formed with the stainless sheet metal 94, and what formed the fine pores 95 from which an aperture differs may be used for the portion located on the cooling water guide rail of this sheet metal 94. In this example, cooling water guide rail length is classified into three, the 5-micrometer fine pores 95 are formed in the field of 1/3 located in the field of 1/3 located in the field of 1/3 located in the upper stream in 15 micrometers and a middle class in 10 micrometers and the lower stream, and the path of fine pores is made small as it progresses downstream from the upper stream. If the humidifying water transparent plate 73b of such composition is used, a humidifying amount can control the humidifying water amount of supply to the downstream which becomes superfluous easily with produced water. Formation of the fine pores to a metal plate can be formed by etching processing, laser beam machining, an electron discharge method, drilling, etc. As for the thickness of a humidifying water transparent plate, it is preferred that it is 0.5 mm or less.
[0054]
[Effect of the Invention]As explained above, according to this invention, a life can be raised substantially.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention]This invention relates to the polymer electrolyte fuel cell using the composite of the inorganic matter which has the poly membrane or hydrogen ion conductivity which has hydrogen ion conductivity or organic-materials powder, and the polymer material as a binder as an electrolyte.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art]In recent years, the fuel cell attracts attention as an efficient energy converting device. A fuel cell is divided roughly into low temperature operation fuel cells, such as an alkali type, a solid polymer type, and a phosphoric acid type, and elevated-temperature operating fuel cells, such as a melting carbonate type and a solid oxide type, by the kind of electrolyte to be used, for example.
[0003]Among these, since high power density is obtained with a compact structure and it can moreover operate by a simple system, the polymer electrolyte fuel cell (PEFC) using the polymer electrolyte membrane which has ion conductivity as an electrolyte attracts attention as power supplies the object for the universes, the object for a detached island, the constant object for grounds, for vehicles, etc.
[0004]What graft-ized trifluoroethylene to the cation exchange membrane of a polystyrene system with a sulfonic group, the mixture of fluorocarbon sulfonic acid and polyvinylidene fluoride, and the fluorocarbon matrix, and was added to them as polymer electrolyte membrane is known. These days, the perfluorocarbon-sulfonic-acid film (for example, Nafion: a trade name, the Du Pont make) etc. are used.
[0005]The polymer electrolyte fuel cell using such polymer electrolyte membrane as an electrolyte is constituted as a layered product structure which carried out the plural laminates of the unit cell 1 usually formed as shown in drawing 17.
[0006]The fuel electrode 11 and the oxidizing agent pole 12 which have been arranged so that the unit cell 1 may be formed by the porous body which supported the polymer electrolyte membrane 10 and the catalyst of platinum etc. and the polymer electrolyte membrane 10 may be pinched by mutual, The fuel electrode side collector 13 made from a porous body by which contact arrangement was carried out at the back of the fuel electrode 11, Two or more fuel-supply slots 15 which are formed in the field in contact with the fuel electrode 11 of the oxidizing agent pole side charge collector 14 by which contact arrangement was carried out, and the fuel electrode side collector 13 at the back of the oxidizing agent pole 12, and carry out distribution supply of the fuel gas at the fuel electrode 11, Two or more oxidizer supply grooves 16 which are formed in the field in contact with the oxidizing agent pole 12 of the oxidizing agent pole side charge collector 14, and carry out distribution supply of the oxidant gas in the oxidizing agent pole 12, It comprises the cold plate 17 formed in the back side of the fuel electrode side collector 13, the cooling water guide rail 18 to which it is provided in this cold plate 17, and shows cooling water, and the humidifying water transparent plate 19 with which some water shown by this cooling water guide rail 18 controls the quantity which shifts to the fuel electrode side collector 13.
[0007]The inside of drawing 17, and 20 and 21, While surrounding the circumference of the membrane electrode complex which consists of the polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 and preventing disclosure of fuel gas and oxidant gas, the frame shape spacer which secures the insulation between the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 is shown. When not making the cold plate 17 intervene, the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 may be unified.

[0008]The polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 are formed in the sheet shaped.
The thickness is formed in 1 mm or less for internal resistance reduction.
The polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12 are formed in the square in consideration of productivity in many cases. And the area is decided by the current value required for power generation, and the current value per unit area, i.e., current density, and there is in general much more than 100 cm^2, i.e., the thing by which one side is set as 10 cm or more.
[0009]As the fuel electrode side collector 13 and the oxidizing agent pole side charge collector 14 are shown in drawing 18 on behalf of the fuel electrode side collector 13, are formed in the square by many according to the shape of the polymer electrolyte membrane 10 or each poles 11 and 12. And according to the shape of each poles 11 and 12, the square field was set as the center section, and the fuel gas supply groove 15 (oxidant gas supply groove 16) is established in two or more parallel to the field of this square. The same might be said of the cold plate 17, the square field was set as the center section according to the shape of each poles 11 and 12, and the cooling water guide rail 18 is established in two or more parallel to the field of this square.
[0010]The both ends of the fuel gas supply groove 15 lead to the fuel gas supply manifold 24 and the fuel gas exhaust manifold 25 which were provided in the edge part of the lamination element in the laminating direction via the interconnecting catwalks 22 and 23 formed in the respectively almost same depth as the fuel gas supply groove 15. Similarly, the both ends of the oxidant gas supply groove 16 lead to the oxidant gas supply manifold 26 and the oxidant gas exhaust manifold 27, and the both ends of the cooling water guide rail 18 lead to the cooling water supply manifold 28 and the cooling-water-discharge manifold 29. On the other hand, the humidifying water transparent plate 19 is formed with the conductive porosity sheet metal which sintered and obtained metal powder or the carbon powder of hydrophilic nature.
[0011]Less than 1V and since the electromotive force of the unit cell 1 constituted in this way is small, two or more unit cells are laminated, and he connects in series, and is trying to acquire required electromotive force. However, if it was in the conventional polymer electrolyte fuel cell constituted as mentioned above, there were the following problems.
[0012]That is, if a cell reaction is made to perform, supplying the oxidant gas containing oxygen to the oxidizing agent pole 12 while supplying the fuel gas which contains hydrogen in the fuel electrode 11, it will be generated by water in the oxidizing agent pole 12 side as a by-product of this cell reaction. This water is called produced water. If this produced water exists so much, it will become the hindrance of supply of oxidant gas. Therefore, it is necessary to eliminate produced water outside promptly. Produced water shifts to the oxidant gas supply groove 16 easily. For this reason, generally, oxidant gas is supplied superfluously and the method of discharging with unreacted oxidant gas is taken. In this method, the rate of flow of oxidant gas serves as an important parameter with the flow of superfluous oxidant gas. That is, many produced water can be discharged, so that the rate of flow is early.
[0013]However, since the square field was set as the center section of the oxidizing agent pole side charge collector 14 formed in the square in the conventional polymer electrolyte fuel cell and the oxidant gas supply groove 16 is established in two or more parallel to the field of this square, It was difficult to raise the rate of flow of oxidant gas, and it difficult to lengthen the life of a cell.
[0014]In order to raise the rate of flow of oxidant gas, the cross-section area, i.e., the tooth depth, and width of each oxidant gas supply groove 16 are realizable by making it small, but when the area of an electrode is small, realization becomes difficult from a point of process tolerance.
[0015]If it is in the conventional polymer electrolyte fuel cell, the fuel electrode 11 and the oxidizing agent pole 12 are formed in an identical size and an identical area. For this reason, it becomes that with which the edge part of the field in contact with the edge part of a field in contact with the polymer electrolyte membrane 10 of the fuel electrode 11 and the polymer electrolyte membrane 10 of the oxidizing agent pole 12 lapped on both sides of the polymer electrolyte membrane 10, When carrying out press forming of the membrane electrode complex

which consists of the polymer electrolyte membrane 10, the fuel electrode 11, and the oxidizing agent pole 12, the pressure concentrated on the edge part, and there was a possibility that the portion in contact with the above-mentioned edge part of the polymer electrolyte membrane 10 might be pushed from both, and might be damaged. In the time of power generation, when the portion pinched by both the above-mentioned edge parts of the polymer electrolyte membrane 10 is in the state where mechanical stress has always started and prolonged operation was performed by bolting of a cell, the portion pinched by both the above-mentioned edge parts of the polymer electrolyte membrane 10 may have deteriorated and damaged it.

[0016]If it is in the conventional polymer electrolyte fuel cell, the humidifying water transparent plate 19 which sintered and obtained metal powder or carbon powder is used. In such a sintered compact, it is easy to produce a difference in porous structure by the conditions of sintering. Control of an aperture uniform at the time of sintering or fine-pores capacity is difficult. For this reason, also in the same humidifying water transparent plate 19, the aperture and fine-pores capacity of each part show dispersion, and an aperture and fine-pores capacity show dispersion about every sheet of the humidifying water transparent plate 19 further. With such dispersion, the humidifying water supplied to the polymer electrolyte membrane 10 became uneven, and the problem which becomes unstable also had battery capacity.

[0017]Although it is thin for miniaturization of a cell and a thing with a mechanical strength is needed, in the conventional manufacturing method which sinters powder, the thickness of about 1 mm of outlines is needed. Since it is a porous body of metal or carbon, if it is made thin, a mechanical strength will be lost, after all, with the conventional humidifying water transparent plate, it can be thin, a thing with a mechanical strength cannot be manufactured, and a compact cell cannot be realized.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, according to this invention, a life can be raised substantially.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]If it was in the conventional polymer electrolyte fuel cell like ****, prompt discharge of produced water was difficult, moreover big mechanical stress was easily added to polymer electrolyte membrane, and there was a problem that the life as a cell was short, for the Reason of being unable to supply water to polymer electrolyte membrane good moreover. Then, an object of this invention is to provide a compact polymer electrolyte fuel cell, while raising a life remarkably.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem]To achieve the above objects, in an invention concerning Claim 1. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell including two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, It is characterized by providing said two or more oxidizer supply grooves that a rectangular field should be covered mostly and oxidant gas should be guided along a long side of the above-mentioned rectangle into a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector.
[0020]In an invention concerning Claim 1, said two or more fuel-supply slots may be provided that it should show fuel gas along a long side of the above-mentioned rectangle in a field in contact with said fuel electrode of said fuel electrode side collector to a field which counters a field of said rectangle.
[0021]In an invention concerning Claim 1, it is still better to provide an internal manifold for supplying said fuel gas and said oxidant gas to said unit cell in the outside of a rectangular field by the shorter side side in a field of said rectangle.
[0022]To achieve the above objects, in an invention concerning Claim 4. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, In a polymer electrolyte fuel cell provided with a unit cell containing two or more oxidizer supply groove **** which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, Said fuel electrode and said oxidizing agent pole are characterized by forming an edge part of a field in contact with said each polymer electrolyte membrane in shape which does not polymerize on both sides of the above-mentioned polymer electrolyte membrane.
[0023]In an invention of Claim 4, area in contact with polymer electrolyte membrane may differ between said fuel electrode and said oxidizing agent pole. In an invention of Claim 4, heights which form a field in contact with said polymer electrolyte membrane are formed in said fuel electrode and said oxidizing agent pole, respectively, and it may be equipped with frame shape reinforcement sheets formed in the almost same thickness as height of the above-mentioned

heights so that these heights might be surrounded. And said frame shape reinforcement sheets may be formed with the same material as said polymer electrolyte membrane.
[0024]To achieve the above objects, in an invention concerning Claim 8. Polymer electrolyte membrane, and a fuel electrode and an oxidizing agent pole which have been arranged so that this polymer electrolyte membrane may be pinched by mutual, A fuel electrode side collector by which contact arrangement was carried out at the back of said fuel electrode, and the oxidizing agent pole side charge collector by which contact arrangement was carried out at the back of said oxidizing agent pole, Two or more fuel-supply slots which are formed in a field in contact with said fuel electrode of said fuel electrode side collector, and carry out distribution supply of the fuel gas at the above-mentioned fuel electrode, Two or more oxidizer supply grooves which are formed in a field in contact with said oxidizing agent pole of said oxidizing agent pole side charge collector, and carry out distribution supply of the oxidant gas in the above-mentioned oxidizing agent pole, A cold plate to which it is provided in the back side of said fuel electrode side collector, and shows cooling water, In a polymer electrolyte fuel cell provided with a unit cell containing a humidifying water transparent plate which controls quantity in which some water which it was provided between this cold plate and said fuel electrode side collector, and was shown by the above-mentioned cold plate shifts to the above-mentioned fuel electrode side collector, Said humidifying water transparent plate is characterized by being formed by a conductive non-sintering member.
[0025]in an invention concerning Claim 8, a hole which may be formed with sheet metal of fluororesin material of porous structure in which said humidifying water transparent plate includes an electrical conducting material and from which it carries out and a size differs was formed — it is monotonous and may be formed.
[0026]Since it has provided that it should show oxidant gas to a rectangular field along a long side of the above-mentioned rectangle in an invention concerning Claim 1 almost covering a field which contacts an oxidizing agent pole of the oxidizing agent pole side charge collector in two or more oxidizer supply grooves, Without making small the depth and width of each oxidizer supply groove (i.e., without it causes difficult-ization of manufacture), the rate of flow of oxidant gas can be made to increase, and, as a result, produced water can be eliminated good.
[0027]That is, it thinks on the basis of area of a fuel electrode (oxidizing agent pole) now. Like the above-mentioned, area of an electrode shall be decided by current density and shall be 100 cm^2 necessity temporarily. Since a square electrode is used in the conventional polymer electrolyte fuel cell, one side is set to 10 cm. On the other hand, in an invention concerning Claim 1, since two or more oxidizer supply grooves are established in a rectangular field almost covering a field in contact with an oxidizing agent pole of the oxidizing agent pole side charge collector, it is not necessary to form an electrode in a square. For example, it may form in a rectangle whose shorter side is 7 cm and whose long side is 14.3 cm. And in an invention concerning Claim 1, an oxidizer supply groove is provided so that oxidant gas may be guided along a rectangular long side. Therefore, when it compares the same [a tooth depth a flute width, and an allocation pitch], there will be few numbers of a slot at an invention which relates to Claim 1 compared with the former. Supposing a supply pressure of oxidant gas is constant, only a part with few numbers of an oxidizer supply groove can make the rate of flow of oxidant gas which carries out conduction of the inside of an oxidizer supply groove increase. Therefore, produced water can be eliminated good.
[0028]That an electrode can be formed in a rectangle in this way can form in a rectangle plane shape of a unit cell, and a cross-section area which can form in a rectangle and intersects perpendicularly with a laminating direction of a fuel cell layered product. That is, since a fuel cell layered product can be flatly formed in near shape where a required electrode area is secured, it becomes possible to correspond also to an object which has only installation space where height is low, for example like an electromobile.
[0029]In an invention concerning Claim 4, a fuel electrode and an oxidizing agent pole are formed so that an edge part of a field in contact with polymer electrolyte membrane of a fuel electrode and an oxidizing agent pole may not polymerize on both sides of polymer electrolyte membrane.

therefore — polymer electrolyte membrane — both edge parts — a portion pinched will not exist. For this reason, when carrying out press forming of the membrane electrode complex, it becomes possible to prevent polymer electrolyte membrane from being damaged by existence of an edge part mentioned above even if it, of course, faced things and cell bolting at the time of power generation.

[0030]Since a humidifying water transparent plate is formed in an invention concerning Claim 8 with a plate with which sheet metal of a conductive non-sintering member, for example, fluororesin material of porous structure containing an electrical conducting material, and fine pores were formed, control of an aperture or fine-pores capacity is very easy. Therefore, it becomes possible to supply humidifying water to polymer electrolyte membrane uniformly.

[0031]

[Embodiment of the Invention]Hereafter, the embodiment of this invention is described, referring to Drawings. The perspective view of the polymer electrolyte fuel cell built over drawing 1 at one embodiment of this invention and the example which connected the polymer electrolyte fuel cell 41 to four-piece series here, and constituted the power supply for electromobiles is shown.

[0032]Each polymer electrolyte fuel cell 41 carries out the plural laminates of the unit cell 42, as shown in drawing 2, The plate conducting 43a and 43b, the electric insulating plates 44a and 44b, and the end plates 45a and 45b of reliance are in the both ends of this layered product, respectively, and it has become what bound tight between 4 corner positions of the end plates 45a and 45b using the insulation rod 46, and was unified in this state.

[0033]The section where the laminating direction and each polymer electrolyte fuel cell 41 constituted in this way crosses at right angles is formed in the rectangle. And a shorter side and a shorter side are made to adjoin, [in / for the four polymer electrolyte fuel cells 41 / the section] It installed in the direction which intersects perpendicularly to the direction by which the unit cell 42 is laminated side by side, and between the layered products which connect the boss bar 47 which protruded on the plate conducting 43a and 43b with the lead 48, and adjoin is electrically connected in series. Thus, the overall height of the space in which a power supply is installed can be made low, and it enables it to install in the space where the height of the under floor of a car, etc. is low by arranging the polymer electrolyte fuel cell 41.

[0034]In each polymer electrolyte fuel cell 41, like the conventional cell, fuel gas required for power generation, The fuel gas supply manifold 49a for supplying and discharging oxidant gas and cooling water, the fuel gas exhaust manifold 49b, The feed water manifold 50a, the drain manifold 50b, the oxidant gas supply manifold 51a, and the oxidant gas exhaust manifold 51b are formed in the laminating direction. In this example, the manifolds to which the adjoining polymer electrolyte fuel cell 41 corresponds are connected in series. Of course, it can also supply in parallel.

[0035]The exploded perspective view of the unit cell 42 is shown in drawing 3. The unit cell 42 is provided with the polymer electrolyte membrane 60 formed with the same construction material as a publicly known thing. This polymer electrolyte membrane 60 is a thing about 0.18 mm thick, Contact arrangement of the fuel electrode 61 and the oxidizing agent pole 62 which were formed in the rectangle (for example, 10 cm of shorter sides, 20 cm of long sides, electrode area 200 cm^2) so that a shorter side might be located in the side by which the manifold is formed in both sides in an area smaller than polymer electrolyte membrane is carried out. The fuel electrode 61 and the oxidizing agent pole 62 are what applied the carbon particle having contained platinum, and are formed in the 0.4-mm-thick surface of the porous body made from carbon.

[0036]The heights 63 which specify the field (area) of the rectangle which contacts the polymer electrolyte membrane 60 as shown in drawing 6 and drawing 7 in the fuel electrode 61 are formed. The heights 64 which specify the field of the rectangle which similarly contacts the polymer electrolyte membrane 60 as shown in drawing 6 and drawing 7 also in the oxidizing agent pole 62 are formed. Unlike the area of the heights 63, the area of the heights 64 is set as size here. That is, edge part A of the heights 63 and edge part B of the heights 64 have an area relation which does not lap with a laminating direction on both sides of the polymer electrolyte membrane 60. Specifically, edge part B has an area relation located in the 2-5-mm outside from edge part A. And it is equipped with the frame shape reinforcement sheets 65 formed in the

sheet shape of the almost same thickness as the height of the heights 63 with the same construction material as the fluoro-resin system sheet of the almost same thickness as the height of the heights 63, or the polymer electrolyte membrane 60 so that the heights 63 formed in the fuel electrode 61 may be surrounded. It is equipped with the frame shape reinforcement sheets 65 which similarly were formed in the same sheet shape also as the circumference of the heights 64 formed in the oxidizing agent pole 62. The sealants 67 and 68 formed in frame shape with insulation sheets, such as fluorocarbon rubber with the almost same thickness as these peripheral parts, are arranged at the peripheral part of the fuel electrode 61 and the oxidizing agent pole 62.

[0037]Contact arrangement of the fuel electrode side collecting electrode plate 69 which exhibits the supply function of fuel gas and current collection function to the fuel electrode 61 is carried out at the back side [of the fuel electrode 61], i.e., drawing 3 of fuel electrode 61, and drawing 6 Nakashita side side. This fuel electrode side collecting electrode plate 69 is formed with the carbon porous plate of hydrophilic nature. In the contact surface with the fuel electrode 61 in the fuel electrode side collecting electrode plate 69, as shown also in drawing 5 and drawing 6, two or more fuel-supply slots 70 for supplying fuel gas to the fuel electrode 61 are formed at the relation prolonged in the direction which meets the long side of the fuel electrode 61 to the field C of a rectangle smaller than the area of the fuel electrode 61. The 50 fuel-supply slots 70 are established, for example in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. Similarly, contact arrangement of the oxidizing agent pole side collecting electrode plate 71 which exhibits the supply function of oxidant gas and current collection function to the oxidizing agent pole 62 is carried out at the drawing 3 [by the side of / 62 / the back of the oxidizing agent pole 62 (i.e., an oxidizing agent pole)], and drawing 6 Nakagami side side. This oxidizing agent pole side collecting electrode plate 71 is formed with the precise carbon plate. In a contact surface with the oxidizing agent pole 62 in the oxidizing agent pole side collecting electrode plate 71, As shown in drawing 4 and drawing 6, two or more oxidizer supply grooves 72 for supplying oxidant gas to the oxidizing agent pole 62 are formed in the relation prolonged in the direction which meets the long side of the oxidizing agent pole 62 to the field D of a rectangle smaller than the area of the oxidizing agent pole 62. For example, 50 of this oxidizer supply groove 72 are provided in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. Drawing 4 is shown as a figure which looked at the oxidizing agent pole side collecting electrode plate 71 from the bottom in drawing 3.

[0038]Contact arrangement of the humidifying water transparent plate 73 is carried out at the drawing 3 [of the fuel electrode side collecting electrode plate 69], and drawing 6 Nakashita side side, and contact arrangement of the cold plate 74 is carried out at the drawing 3 [of this humidifying water transparent plate 73], and drawing 6 Nakashita side side. The humidifying water transparent plate 73 so that it may be shown in the non-sintering board which has conductivity, for example, drawing 8, To both sides of the stainless sheet metal 76 which formed hundreds of fine pores 75 with the aperture of 10 micrometers in the region disposing of the fuel gas supply groove 70, and the field which counters. It is a thing with a thickness of 0.16 mm which has arranged the sheet metal 77 in which carbon was made to mix 30% on the porosity fluoro-resin system sheet of 10 micrometers in an aperture, and 70% of fine-pores capacity, and was united with it, and is formed.

[0039]The cold plate 74 is formed with a precise carbon plate or metal plate. Two or more guide rails 78 for showing cooling water to the field located in the humidifying water transparent plate 73 side of the cold plate 74 are formed in the region disposing of the fuel gas supply groove 70, and the field which counters in parallel with the fuel gas supply groove 70.

[0040]Both the short side parts of the polymer electrolyte membrane 60, the frame shape reinforcement sheets 65 and 66, the sealants 67 and 68, the fuel electrode side collecting electrode plate 69, the oxidizing agent pole side collecting electrode plate 71, the humidifying water transparent plate 73, and the cold plate 74 (by the shorter side side of the rectangular fields C and D.) And out of the field of the above-mentioned rectangle, The holes 82 and 83, the oxidant gas supply manifold 51a, and the oxidant gas exhaust manifold 51b which constitute the holes 80 and 81, the feed water manifold 50a, and the drain manifold 50b which constitute the

fuel gas supply manifold 49a and the fuel gas exhaust manifold 49b. The holes 84 and 85 to constitute are formed in the relation which leads to a laminating direction, respectively.
[0041]And the fuel gas supply groove 70 established in the fuel electrode side collecting electrode plate 69 leads to the holes 80 and 81 for supplying / discharging fuel gas, The oxidizer supply groove 72 established in the oxidizing agent pole side collecting electrode plate 71 leads to the holes 82 and 83 for the guide rail 78 established in the cold plate 74 to supply / discharge cooling water through the holes 84 and 85 for supplying / discharging oxidant gas.
[0042]Thus, in the polymer electrolyte fuel cell 41 concerning this example. Since two or more oxidizer supply grooves 72 of the field in contact with the oxidizing agent pole 62 of the oxidizing agent pole side charge collector 71 which show mostly oxidant gas to the rectangular field D along a rectangular long side are formed, The produced water by which could make the rate of flow of oxidant gas increase, and it was generated as a result in the oxidizing agent pole 62 can be eliminated good, without making small the depth and width of each oxidizer supply groove.
[0043]That is, in the case of this example, the thing of 10 cm of shorter sides, 20 cm of long sides, and electrode area 200 cm^2 is used as the oxidizing agent pole 62, and the 50 oxidizer supply grooves 72 are formed in 1 mm in width, a depth of 0.5 mm, 20 cm in length, and a 2-mm pitch. If current density is made into $0.4A/cm^2$, an air utilization rate is made into 40% now and an oxidant gas (air) supply pressure is set to 1atm, the rate of flow of the oxidant gas which flows through each oxidizer supply groove 72 will be set to sec in 300 cm /. On the other hand, it is a square electrode (14 cm in length of one side) at the same electrode area 200 cm^2. When it uses, the oxidizer supply groove of the same flute width, a channel depth, and an allocation pitch is provided and oxidant gas is supplied on the same conditions, the rate of flow of the oxidant gas which flows through each oxidizer supply groove is set to sec in 210 cm /. Thus, though it is the same electrode area, the rate of flow of oxidant gas can be made to increase by 1.5 times in this example. Therefore, produced water can be discharged good. As a result, it can be lost that produced water stagnates in the oxidizing agent pole 62, and bars supply of oxidant gas, a long time can be covered, and battery capacity can be maintained.
[0044]That the oxidizing agent pole 62 and the fuel electrode 61 can be formed in a rectangle in this way can form in a rectangle the plane shape of the unit cell 42, and the cross-section area which can form in a rectangle and intersects perpendicularly with the laminating direction of a fuel cell layered product. That is, since a fuel cell layered product can be flatly formed in near shape where a required electrode area is secured, it becomes possible to correspond also to the object which has only the installation space where height is low, for example like an electromobile.
[0045]In the above-mentioned example, the fuel electrode 61 and the oxidizing agent pole 62 are formed so that edge part [of a field] A in contact with the polymer electrolyte membrane 60 of the fuel electrode 61 and the oxidizing agent pole 62 and B may not polymerize on both sides of the polymer electrolyte membrane 60. Therefore, both edge part A and the portion B Depended and pinched will not exist in the polymer electrolyte membrane 60. For this reason, when carrying out press forming of the membrane electrode complex, it becomes possible to prevent the polymer electrolyte membrane 60 from being damaged by existence of edge part A mentioned above even if it, of course, faced things and cell bolting at the time of power generation, and B.
[0046]The result of having done the power generation examination for comparing performance is shown in drawing 9 using the unit cell concerning this example, and the unit cell of a conventional example. Although cell voltage fell to 0.2V by the unit cell of the conventional example in about 2000 hours, even if it exceeded 4000 hours, the fall of cell voltage was not seen by the unit cell concerning this example.
[0047]When the power generation examination was done using the fuel electrode and oxidizing agent pole which the periphery of the electrode manufactured with the screen printer using a screen pattern which becomes thin only the thickness of the frame shape reinforcement sheets 65 and 66, the result equivalent to the characteristic shown in drawing 9 was obtained. Since it forms with the sheet metal of the fluororesin material of the porous structure which includes a conductive non-sintering member and an electrical conducting material for the humidifying water

transparent plate 73 in the above-mentioned example, and the metal plate provided with fine pores, Control of an aperture or fine-pores capacity is very easy, and, as a result, can supply humidifying water to the polymer electrolyte membrane 60 uniformly.
[0048]That is, the power generation test result of 5 cell layer built cell which laminated five steps of unit cells concerning the above-mentioned example is shown in drawing 10, and the power generation test result of 5 cell layer built cell which laminated five steps of unit cells of the conventional example is shown in drawing 11.
[0049]With the layer built cell using the unit cell of the conventional example, cell voltage varied for every cell from immediately after the power generation start, and also in 5000 hours, cell voltage has varied and fell by an average of 0.12 morev. However, with the layer built cell using the unit cell concerning this example, cell voltage has gathered from immediately after the power generation start, and neither dispersion in cell voltage nor a fall was seen also in 5000 hours. What compounded 100 meshes, and the fluoro-resin system sheet and carbon of the mesh structure of 85 micrometers of wire sizes 30% as the humidifying water transparent plate 73, When the above-mentioned power generation examination was done on the central field (10 cm x 10 cm) using the stainless sheet metal which provided 300 10-micrometer fine pores by etching processing, both sides obtained the equivalent result. These are because humidifying water was uniformly supplied to the polymer electrolyte membrane 60.
[0050]This invention is not limited to the example mentioned above, and can change variously. That is, although the size of the fuel electrode 61 and the size of the oxidizing agent pole 62 are made the same, it may be made to differ in the above-mentioned example, as shown in drawing 12.
[0051]As shown in drawing 13, area of the polymer electrolyte membrane 60 may be made the same as the size of the fuel electrode 61 or the oxidizing agent pole 62, and the sealant 91 formed in the outside with the fluoro-resin system sheet etc. at frame shape may be arranged. As shown in drawing 14, the composition of having changed only the size of the fuel electrode 61 and the oxidizing agent pole 62 may be used.
[0052]As it is not restricted to the example which the composition of the humidifying water transparent plate also mentioned above and is shown in drawing 15, The humidifying water transparent plate 73a with which it was formed by the member 92 which composite-ized the fluoro-resin system sheet whose portion corresponding to the field in which the cooling water guide rail of the cold plate is established is mesh structure, and carbon, and the surroundings of it were formed by the members 93, such as a fluoro-resin system sheet, may be used.
[0053]As shown in drawing 16, the humidifying water transparent plate 73b may be formed with the stainless sheet metal 94, and what formed the fine pores 95 from which an aperture differs may be used for the portion located on the cooling water guide rail of this sheet metal 94. In this example, cooling water guide rail length is classified into three, the 5-micrometer fine pores 95 are formed in the field of 1/3 located in the field of 1/3 located in the field of 1/3 located in the upper stream in 15 micrometers and a middle class in 10 micrometers and the lower stream, and the path of fine pores is made small as it progresses downstream from the upper stream. If the humidifying water transparent plate 73b of such composition is used, a humidifying amount can control the humidifying water amount of supply to the downstream which becomes superfluous easily with produced water. Formation of the fine pores to a metal plate can be formed by etching processing, laser beam machining, an electron discharge method, drilling, etc. As for the thickness of a humidifying water transparent plate, it is preferred that it is 0.5 mm or less.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The perspective view showing an example of the mounting configuration of the polymer electrolyte fuel cell concerning one embodiment of this invention
[Drawing 2]The side view of the polymer electrolyte fuel cell
[Drawing 3]The exploded perspective view of the unit cell included in the polymer electrolyte fuel cell
[Drawing 4]The figure showing the 1 surface of the oxidizing agent pole side collecting electrode plate built into the unit cell
[Drawing 5]The figure showing the 1 surface of the fuel electrode side collecting electrode plate built into the unit cell
[Drawing 6]Drawing of longitudinal section of the unit cell
[Drawing 7]The decomposition sectional view of the important section of the unit cell
[Drawing 8]The exploded perspective view of the humidifying water transparent plate built into the unit cell
[Drawing 9]The figure showing the power generation characteristic of the unit cell as compared with a conventional example
[Drawing 10]The figure showing the power generation characteristic of the polymer electrolyte fuel cell
[Drawing 11]The figure showing the power generation characteristic of the conventional polymer electrolyte fuel cell
[Drawing 12]The figure for explaining the modification of this invention
[Drawing 13]The figure for explaining another modification of this invention
[Drawing 14]The figure for explaining another modification of this invention
[Drawing 15]The figure for explaining the modification from which this invention differs
[Drawing 16]The figure for explaining a further different modification of this invention
[Drawing 17]Drawing of longitudinal section of the unit cell included in the conventional polymer electrolyte fuel cell
[Drawing 18]The figure showing the 1 surface of the fuel electrode side collecting electrode plate built into the unit cell
[Description of Notations]
41 -- Polymer electrolyte fuel cell
42 -- Unit cell
49a -- Fuel gas supply manifold
49b -- Fuel gas exhaust manifold
50a -- Feed water manifold
50b -- Drain manifold
51a -- Oxidant gas supply manifold
51b -- Oxidant gas exhaust manifold
60 -- Polymer electrolyte membrane
61 -- Fuel electrode
62 -- Oxidizing agent pole

63, 64 -- Heights
65, 66 -- Frame shape reinforcement sheets
67, 68 -- Sealant
69 -- The fuel electrode side collecting electrode plate
70 -- Fuel-supply slot
71 -- The oxidizing agent pole side collecting electrode plate
72 -- Oxidizer supply groove
73, 73a, 73b -- Humidifying water transparent plate
74 -- Cold plate
78 -- Guide rail
A, B -- Edge part
C, D -- Rectangular field

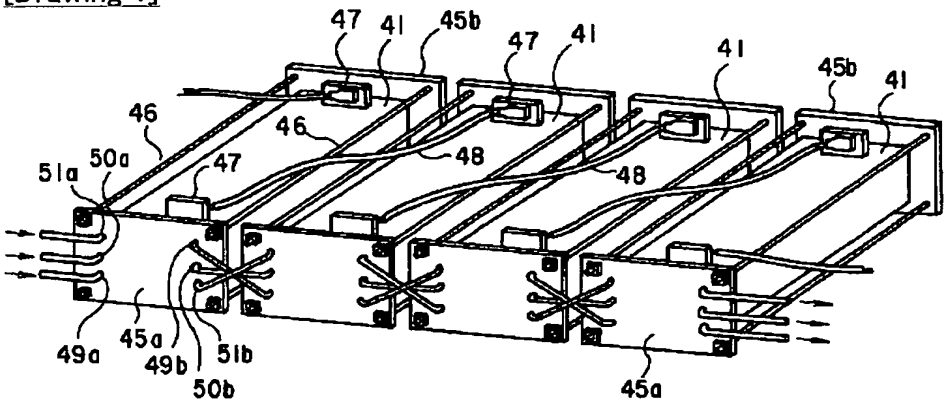
[Translation done.]

* NOTICES *

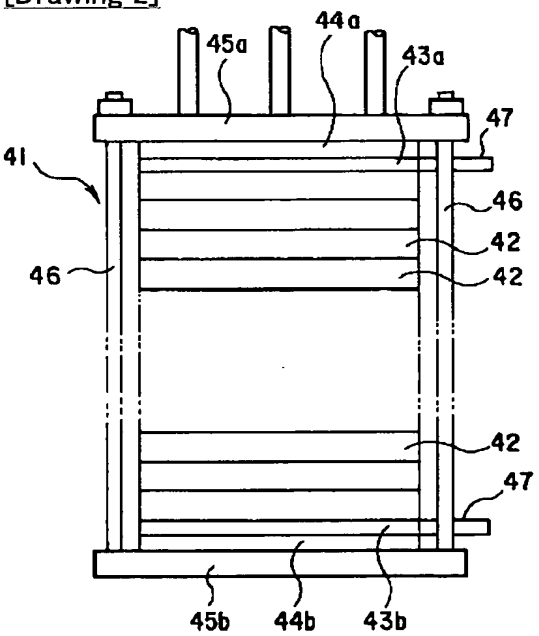
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

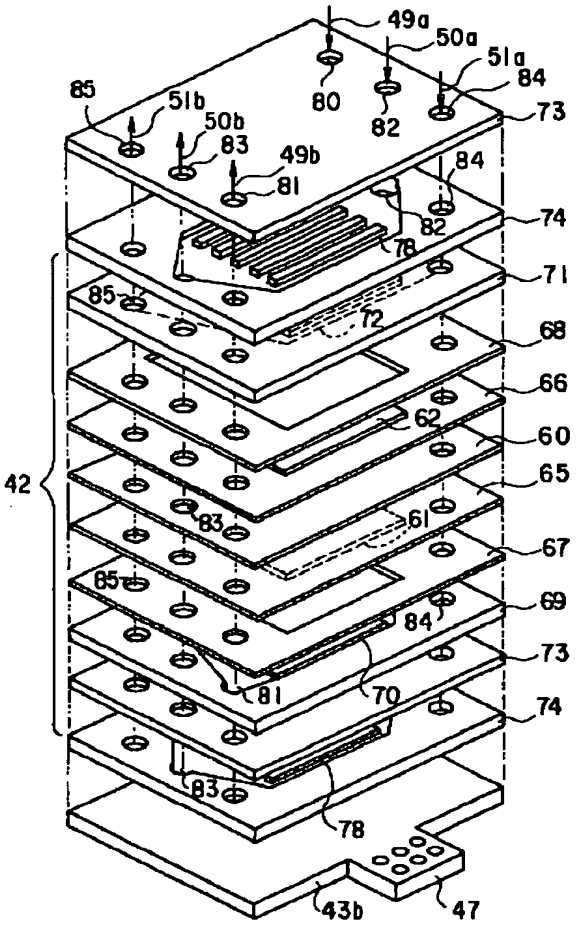
[Drawing 1]



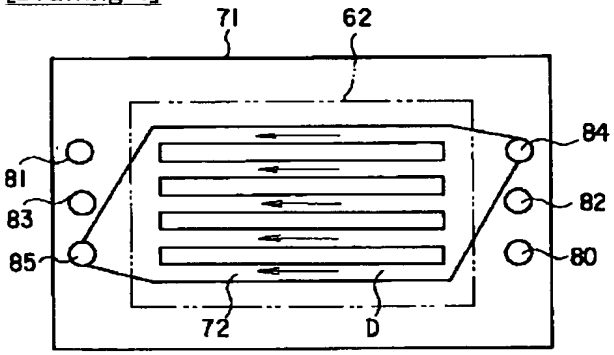
[Drawing 2]



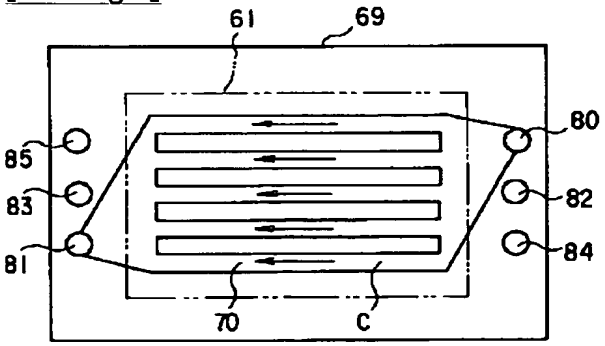
[Drawing 3]



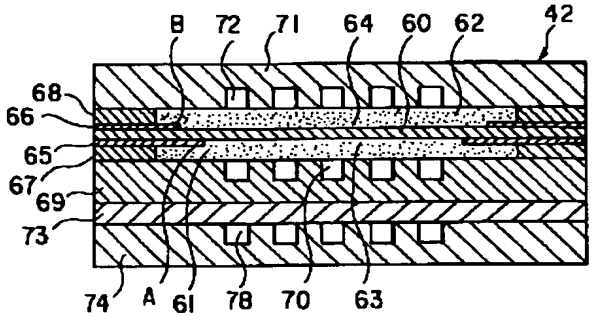
[Drawing 4]



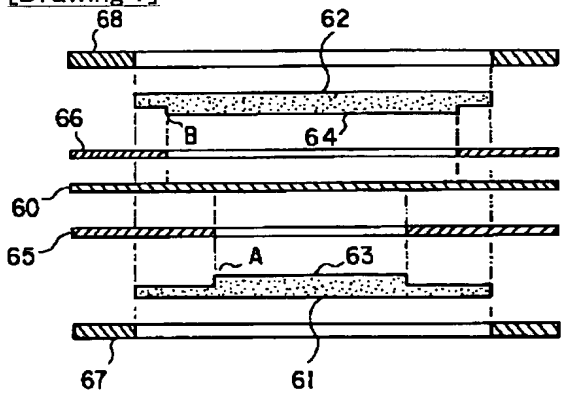
[Drawing 5]



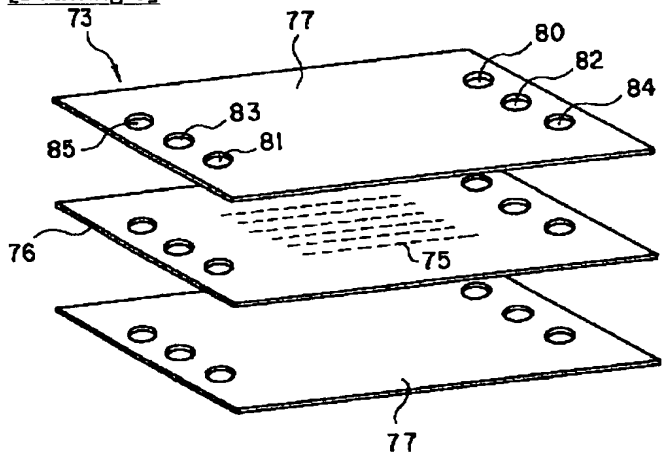
[Drawing 6]



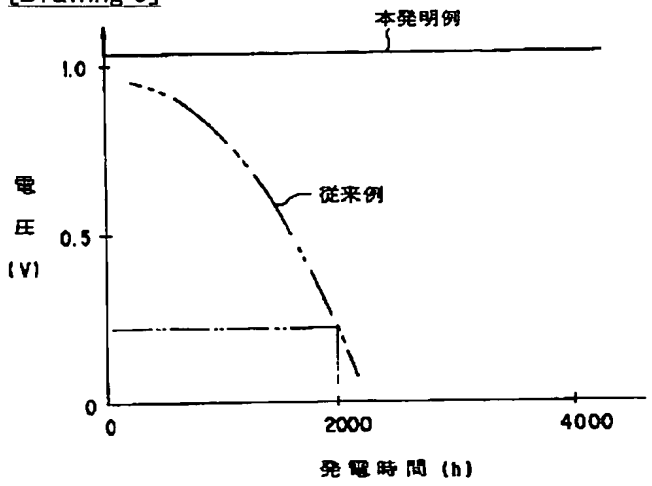
[Drawing 7]



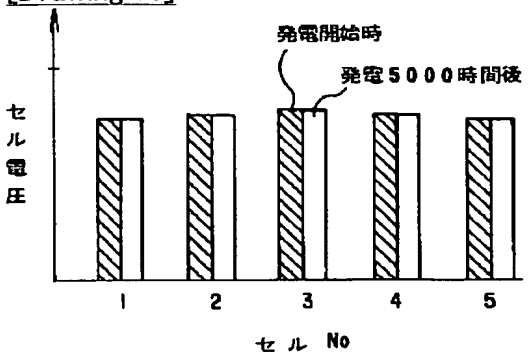
[Drawing 8]



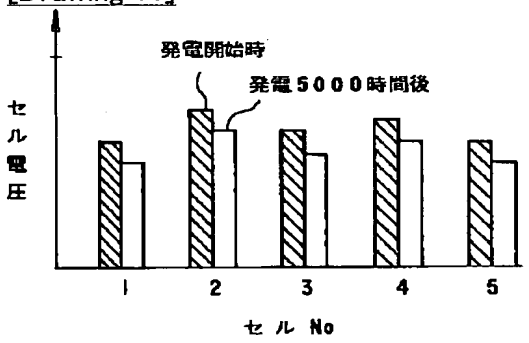
[Drawing 9]



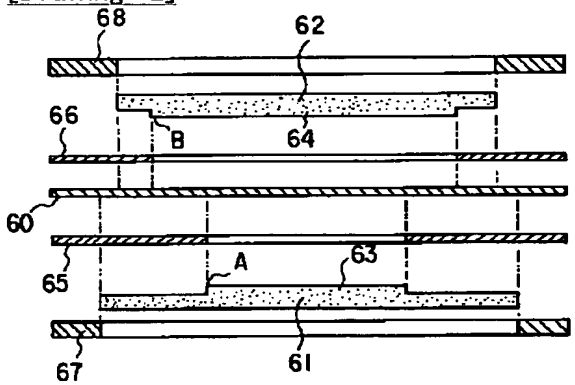
[Drawing 10]



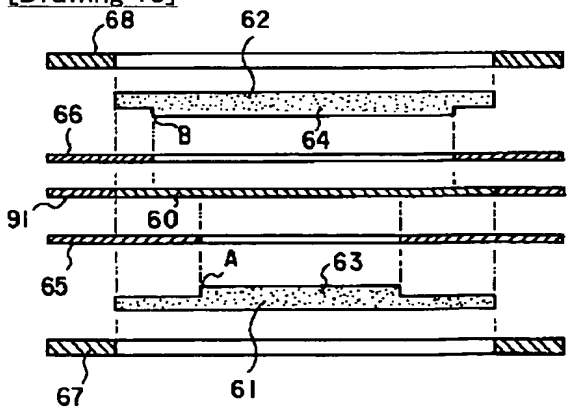
[Drawing 11]



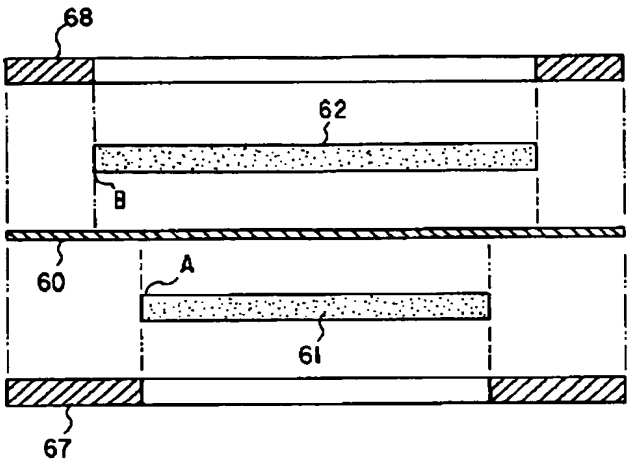
[Drawing 12]



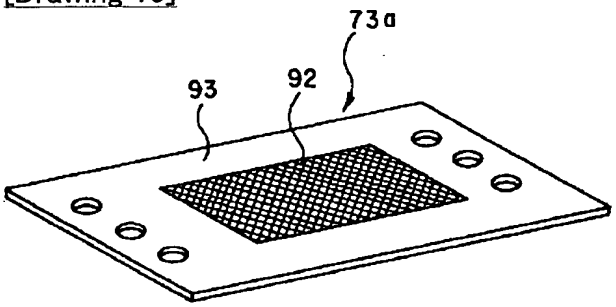
[Drawing 13]



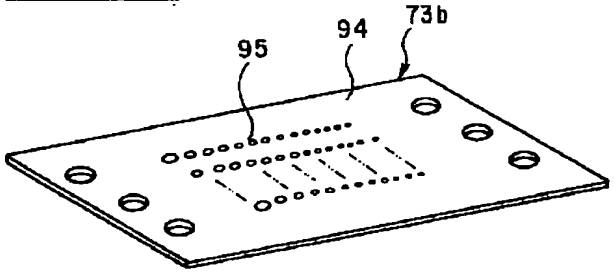
[Drawing 14]



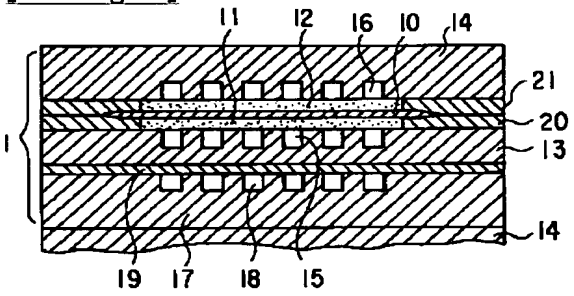
[Drawing 15]



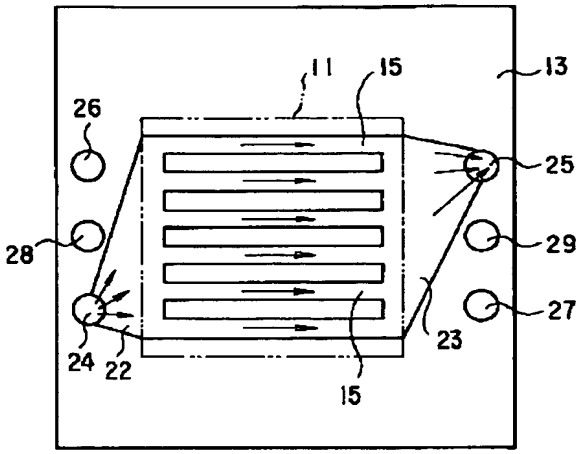
[Drawing 16]



[Drawing 17]



[Drawing 18]



[Translation done.]